S. Hrg. 100–258 Pt. 2

DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 1988

HEARINGS

BEFORE A

SUBCOMMITTEE OF THE
COMMITTEE ON APPROPRIATIONS
UNITED STATES SENATE

ONE HUNDREDTH CONGRESS

FIRST SESSION

ON

H.R. 3576/S. 1923

AN ACT MAKING APPROPRIATIONS FOR THE DEPARTMENT OF DEFENSE FOR THE FISCAL YEAR ENDING SEPTEMBER 30, 1988, AND FOR OTHER PURPOSES

PART 2 (Pages 1–457)

ARMY AIRCRAFT PROGRAMS
STRATEGIC DEFENSE INITIATIVE

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DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 1988

TUESDAY, MARCH 17, 1987

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 10 a.m., in room SD–192, Dirksen Senate Office Building, Hon. John C. Stennis (chairman) presiding.

Present: Senators Stennis, Proxmire, Johnston, Sasser, DeConcini, Stevens, Weicker, Kasten, Rudman, and Cochran.

DEPARTMENT OF DEFENSE

DEPARTMENT OF THE ARMY

STATEMENTS OF:

- LT. GEN. LOUIS C. WAGNER, JR., DEPUTY CHIEF OF STAFF FOR RESEARCH, DEVELOPMENT AND ACQUISITION, U.S. ARMY
- LT. GEN. ROBERT W. RISCASSI, DEPUTY CHIEF OF STAFF FOR OPERATIONS AND PLANS, U.S. ARMY

ACCOMPANIED BY:

- MAJ. GEN. ELLIS D. PARKER, COMMANDER, FORT RUCKER, CHIEF OF AVIATION
- BRIG. GEN. RONALD K. ANDRESON, PROJECT MANAGER, LHX

ARMY AIRCRAFT PROGRAMS

OPENING STATEMENT OF CHAIRMAN STENNIS

Chairman STENNIS. Ladies and gentlemen, we are glad to have you here. This is a busy day on Capitol Hill; several hearings are going on this morning and debates and argument this afternoon.

We have a number of knowledgeable witnesses on Army aircraft programs, and we have a number of interested members of our Appropriations Committee, a good number of whom I am expecting to be here in person. I think they will show up in a few minutes.

I have had a look-see already at the major points involved about the weapons themselves and about the conditions, but it will all be worth hearing many times over. I am looking forward to what has a possibility here of a very fine presentation. I am not going, at this point at least, to take up the time of witnesses. Other members will be here, and we will all have a chance to ask questions.

Now, General Wagner, would you like to introduce your witnesses from the Army today? Suppose you just introduce them. They are here at the table, as I understand.

INTRODUCTION OF WITNESSES

General WAGNER. Yes, sir; it is a pleasure for us to be here today to present to you our aviation program for 1988–89. I have with me today Lieutenant General RisCassi, on my left, who is the Army's Deputy Chief of Staff for Operations and Plans. Immediately to his left is General Parker, who is the Commander of Fort Rucker and our Chief of Aviation, and to my right is Brigadier General, soon to be Major General, Andreson, who is the project manager for our No. 1 R&D program, the LHX helicopter.

Chairman STENNIS. We are glad to have each of you. Senator Stevens of Alaska has come in. He is a valuable member of the committee, a hard worker, and knows what he is talking about, too. I am glad he got here.

We will proceed now, gentlemen, and with all allowances I have a statement here, an opening statement, and I ask unanimous consent that I be permitted to put it in the record.

[The prepared statement of Chairman Stennis follows:]

PREPARED STATEMENT OF HON. JOHN C. STENNIS

U.S. SENATOR FROM MISSISSIPPI

Good morning, ladies and gentlemen. The subject of our hearing today is Army aviation. As our military forces have modernized, aviation has become an increasingly important component of total combat capability. We in the Congress usually think about the Air Force and Navy as the primary elements of military aviation. Yet, the Army has more than 8,500 aircraft. These are not long-range bombers or fighter aircraft; for the most part Army aircraft are helicopters. But the role they play is very important to the ability of the United States to protect itself from aggression.

When we speak of helicopters, we are no longer just referring to troop carriers. The helicopters of today are sophisticated, highly capable and very expensive pieces of equipment. They are used to project firepower, to provide reconnaissance and to increase mobility of our military forces. Further, helicopters are continuing to be modernized. Lightweight materials, advances in vertical flight technologies and new weapons systems allow for improvements in helicopter capability.

The budget request for Army aviation investment is approximately $2.9 billion for procurement and research and development. This is nearly the same amount funded last year, but it represents a 10-percent decrease in procurement and a 300-percent increase in research and development. The Army's decision to reduce its spending on aviation production and increase research will be reviewed at this hearing.

The Army stands at a crossroads today. The Army has a large number of utility, attack and scout helicopters which need to be replaced or modernized. For the past few years, the Army has been fielding a new generation of utility and attack helicopters, the Blackhawk and Apache, and modernizing a scout version, the Army Helicopter Improvement Program [AHIP]. These aircraft greatly improve combat capability; however, with limited resources, the Army believes it cannot afford to purchase all that it needs. To resolve this dilemma, the Army has chosen to develop a new single aircraft, the light experimental helicopter [LHX], which can perform all three missions, but which it believes will be more affordable. However, the cost of LHX development has caused the Army to curtail procurement of these other helicopters.

There are members of this subcommittee who have expressed concern with the Army's decisions to reduce current production and await a new helicopter of uncertain design which won't be produced for many years. Our witnesses will discuss the Army's plans in this area.

The Army's decision to cut back its current procurement programs also leads to questions concerning its need for these programs in fiscal year 1987. Last year, the committee directed the Army to report on its plans to replace scout aircraft. The committee denied the use of scout modernization funds, the Army Helicopter Improvement Program, if the Army decided to cancel this program in 1988. Now the Army has requested that the committee release these funds prior to its explanation. We need to know why this aircraft should be purchased this year if the Army plans to cancel this program next year.

Finally, the committee also instructed the Army to report on the cost of the new LHX Program before it spent the funds which were appropriated last year. The Army has not yet informed the committee of the program costs, but it has asked the committee to allow it to spend the appropriated funds nonetheless.

As you can see, there are many issues which need to be discussed and clarified today. The budget which we are reviewing may have to be reduced, and the Army needs to explain its plans to assist the committee in providing the best recommendations to the Senate on these important programs.

To help us in our review, we are pleased to have Lt. Gen. Louis Wagner, the Deputy Chief of Staff of the Army for Research, Development, and Acquisition, and Lt. Gen. Robert W. RisCassi, the Deputy Chief of Staff of the Army for Operations and Plans. These gentlemen are accompanied today by Maj. Gen. Ellis D. Parker, the Commanding General of the Aviation Command and Fort Rucker, and Brig. Gen. Ronald K. Andreson, the program manager of the Light Helicopter [LHX] Program. We hope that these witnesses will be able to answer the questions raised by the subcommittee.

Gentlemen, we will proceed with your presentations. I would suggest that the members of the subcommittee allow both of these gentlemen to testify before we open up the hearing to questions.

SLIDE PRESENTATION

Chairman Stennis. I believe we better start out now. Who is the first witness?

General Wagner. Mr. Chairman, I would ask first that our complete witness statement for the record be entered in the record.

Chairman Stennis. Whose statement is that?

General Wagner. That is our statement, Lieutenant General RisCassi's statement and my statement. We have submitted to the committee a joint written statement for the record that covers many of the questions that we were asked to cover today.

Chairman Stennis. Without objection, that testimony will be placed in the record at the conclusion of your testimony. My question was, though, who you have now you want to proceed to testify. You are subject to cross examination more if you testify than if you just put a paper in the record.

General Wagner. Yes, sir.

Chairman Stennis. If you want to go first yourself, that will be all right, too.

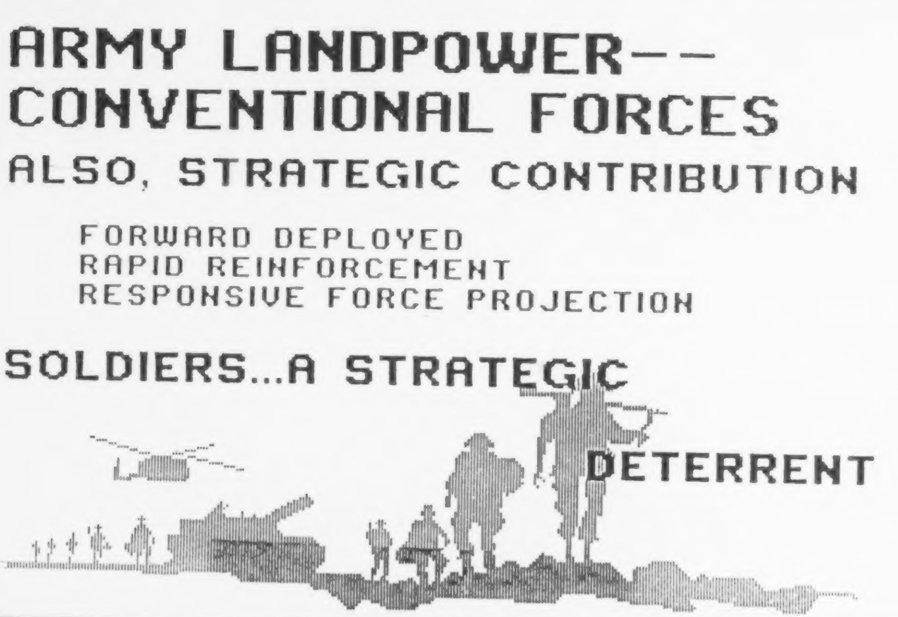
General Wagner. Sir, two of us are going to testify today before we open it to questions; basically to lay the background of how we came up with our program. First, General RisCassi will discuss with you how we develop our requirements.

Chairman STENNIS. All right. Thank you very much. General, you proceed. I am going to ask the photographers to divide time with us here while we are looking at this slide particularly. We need undiminished and unbroken line of communications and sight. So it has got to be kept clear where the committee members can see it.

Proceed.

AVIATION ACQUISITION STRATEGY

General RISCASSI. Sir, what I thought I would do for you this morning is lay the background that actually frames the acquisition strategy, particularly the aviation acquisition strategy, by which we measure the effectiveness of the program. I will give you a little bit of a refresher on doctrine, a little bit on force structure, and then transaction to evolve into General Wagner's presentation. Hopefully these slides are not so light so you can't see them.



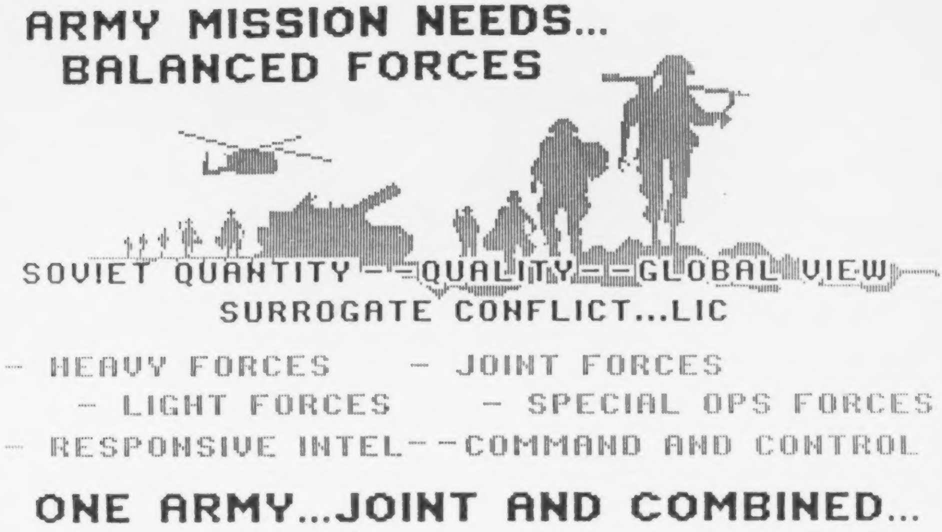
ARMY LANDPOWER--
CONVENTIONAL FORCES
ALSO, STRATEGIC CONTRIBUTION

FORWARD DEPLOYED
RAPID REINFORCEMENT
RESPONSIVE FORCE PROJECTION

SOLDIERS...A STRATEGIC DETERRENT

FORCE LOCATION

General RISCASSI. Basically this slide shows for you where the forces are. You have forward-deployed forces and sustaining-base forces. And what that says to you as you develop your doctrine is that it must have universal applicability, a balanced perspective so that the totality of the force can be brought together at the appropriate time.



ARMY MISSION NEEDS...
BALANCED FORCES

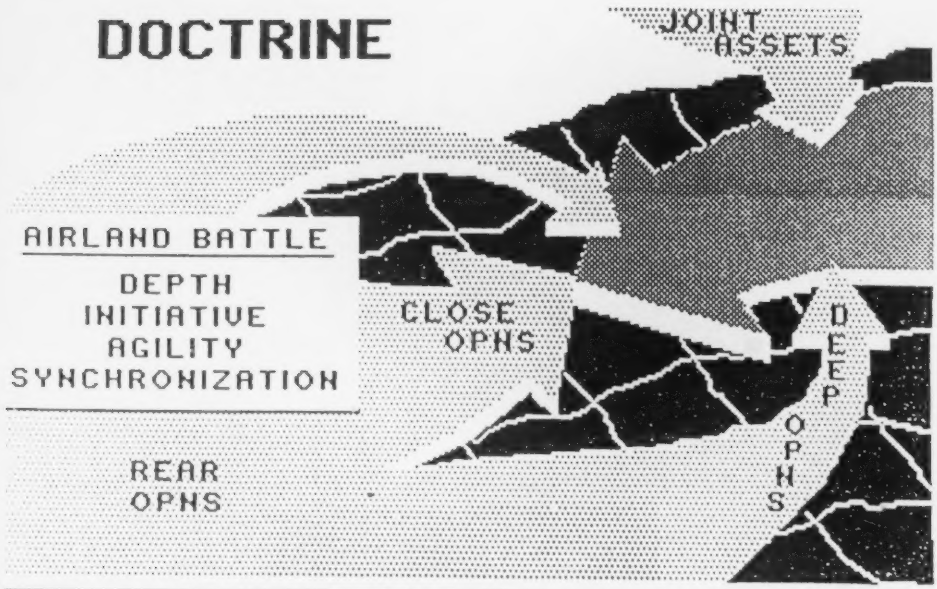
SOVIET QUANTITY--QUALITY--GLOBAL VIEW
SURROGATE CONFLICT...LIC

- HEAVY FORCES - JOINT FORCES
- LIGHT FORCES - SPECIAL OPS FORCES
- RESPONSIVE INTEL--COMMAND AND CONTROL

ONE ARMY...JOINT AND COMBINED...

FORCE PROJECTIONS

General RisCassi. Why do we need that capability? Basically it is because of the power projection or force projection capability of our major adversary, the Soviets. What we have depicted on this slide is a heavy force, a light force, a special operations force, which gets to the required balance in the projection of the force as it is seen in the context of the doctrine, the air-land battle doctrine of the U.S. Army.



TRAINING DOCTRINE COMMAND

General RisCassi. Let us just talk a little bit about our doctrine. As you know, after the Vietnam era, the Training and Doctrine Command [TRADOC], set about examining what had been our doctrine and developing it to that which was euphemistically called at that time, an active defense. The latter evolved into what we know in the 1987 timeframe as air-land battle.

Now why did we do that? We felt that the past doctrine was unidimensional. In other words, it did not effect the totality of organizations and the training of these forces. And further, it was not balanced enough to do what we thought had to be done to win wars.

So we set about looking at history for principles that were time-tested and would form the tenets of doctrine. These are depicted in this slide as agility, initiative, synchronization, and depth, major tenets all four, taken in concert with one another. If you looked at why initiative, it has been the cornerstone of the U.S. Army for years. You must have initiative when you have a finite number of soldiers and organizations to work with. Therefore, we felt that initiative was one of the key building blocks and cornerstones of this doctrine.

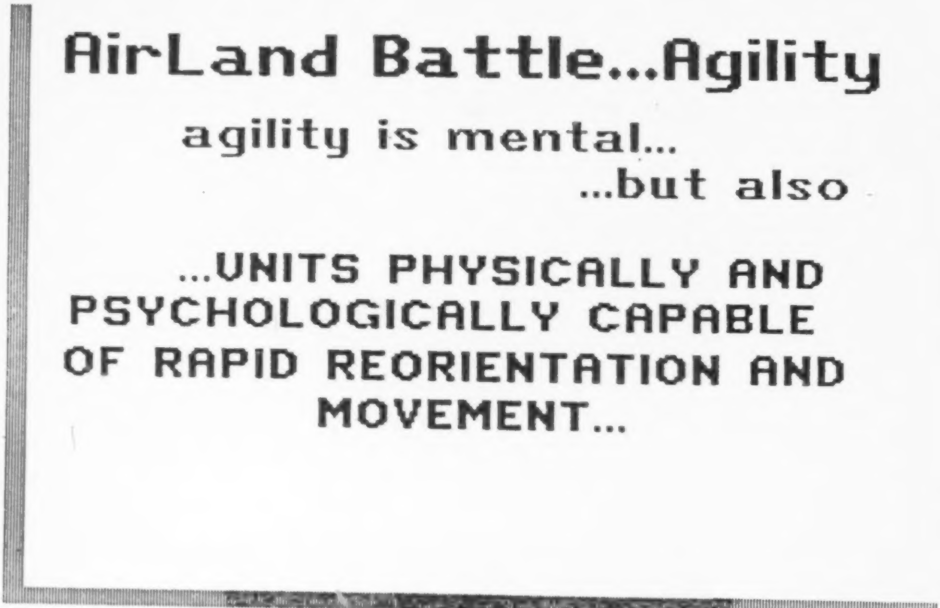
Synchronization. Why? Because if you are going to talk in terms of deep operations, a main battle operations, and a rear operations, or those three in concert with one another, one must synchronize accomplishment of the fundamental tasks that are implicit in each one of those operations to allow the battle commander's focus of attention.

DEPTH OF FORCES

Depth. To be successful we have found that you must project your forces to the operational depth of the Soviet forces. You must look forward as well as to your rear, in addition to the immediate battle.

AGILITY

And, of course, the last tenet, which is implicit in the subject this morning, is agility, in the case of aviation a function of breaking friction with the ground and using the dimension of the air as part of the doctrinal venue.



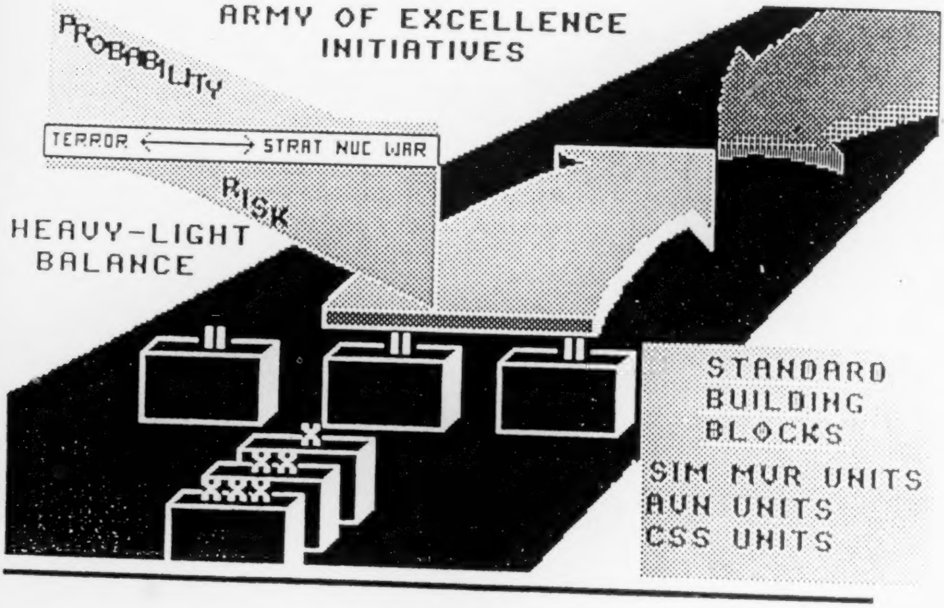
AirLand Battle...Agility

agility is mental...
...but also

...UNITS PHYSICALLY AND PSYCHOLOGICALLY CAPABLE OF RAPID REORIENTATION AND MOVEMENT...

AGILITY

General RisCassi. This slide covers what I have said on agility.

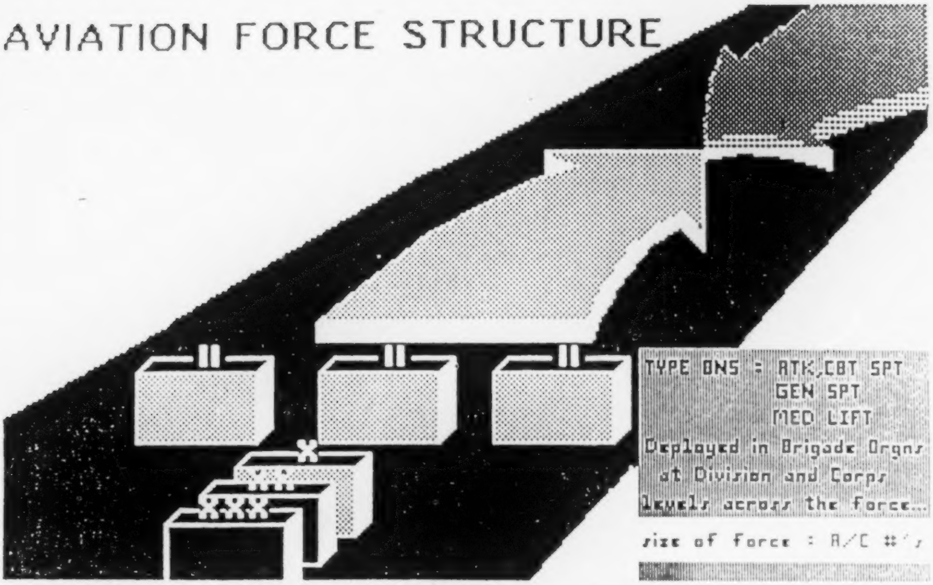

ARMY OF EXCELLENCE
INITIATIVES
PROBABILITY
TERROR ⟷ STRAT NUC WAR
RISK
HEAVY-LIGHT
BALANCE
STANDARD
BUILDING
BLOCKS
SIM MVR UNITS
AVN UNITS
CSS UNITS

AIR-LAND BATTLE

General RisCassi. Now, as I indicated, the subject this morning is aviation. When we looked across the spectrum of conflict and looked at how one would like to balance heavy and light forces, we really need to start building standard building blocks, even though you had typical type divisions.

This means if you look at a heavy division, at a company team organization, it ought to look basically the same in a mechanized or tank division in Europe as it does in a tank or mechanized division in the sustaining base force or Conus. Actually, if you looked at a light division across the spectrum—one in Hawaii, one in Alaska, and three formed or forming in the United States—all the basic building blocks of that organization, from the company on up, would absolutely look the same.

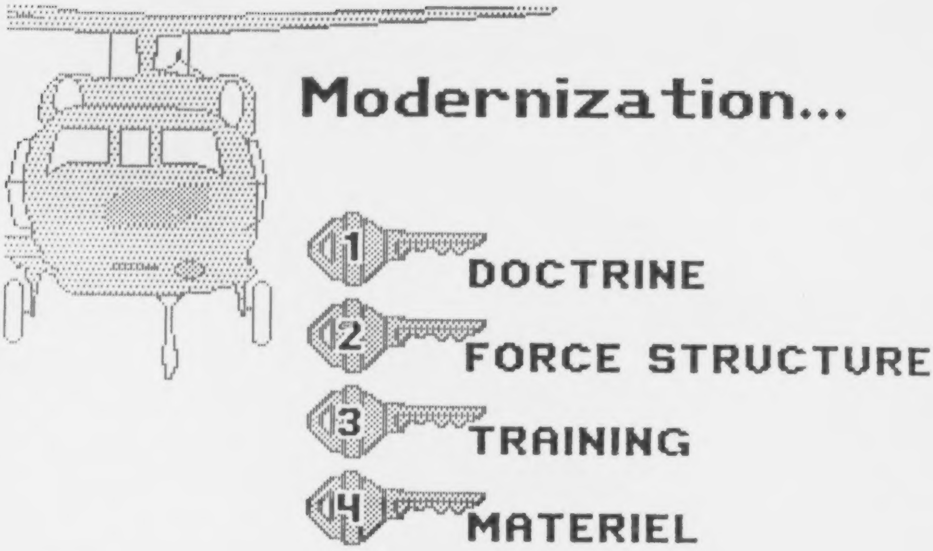
Why? It makes for ease of training. It makes for ease of power projection. It makes for ease of equipping and it just absolutely makes sense in prosecuting this doctrine.


AVIATION FORCE STRUCTURE
TYPE BNS = ATK,CBT SPT
GEN SPT
MED LIFT
Deployed in Brigade Orgns
at Division and Corps
Levels across the Force...
size of Force : A/C #'s

AVIATION FORCE STRUCTURE

General RisCassi. When you look at the aviation force structure, and we went back to the Vietnam era, we took advantage of the Howze Board and the Ansbach test and then subsequent tests at Fort Hood and at Fort Lewis, it started to tell you a story. You had a loose confederation of piece parts called aviation assets in your divisions and corps.

It made infinite sense to structure that organization under one organizational entity called a brigade, make it part of the division or corps organization so that you could in fact prosecute better the doctrine that we were laying on the table which at that point in time was called the AirLand Battle Doctrine.



Modernization...

1 DOCTRINE

2 FORCE STRUCTURE

3 TRAINING

4 MATERIEL

MODERNIZATION

General RisCassi. Mr. Chairman, there are four keys to causing change in the Army. One is doctrine. Although you can do that rather rapidly through a studied effort, to get that inculcated in your Armed Forces takes a significant amount of time, so that every soldier from private to general understands the basic tenets and how to fight that doctrine on the battlefield. You can change force structure, and in fact I would argue that we have changed our doctrine and we have changed our force structure to come to grips not only with the 1990's but with the 21st century.

You have to tie all of this together through a very proactive training program. I would also submit that this is part of your field Army today. And then the last part, that General Wagner will talk about, is modernizing your force through materiel acquisition.

Chairman Stennis. all right, General. Thank you very much.

ACQUISITION PRINCIPLES

- DOCTRINALLY BASED EQUIPMENT
- ROBUST, THREAT ORIENTED RESEARCH AND DEVELOPMENT
- ECONOMIC BUY RATES – TRY TO GET IN, GET OUT
- MAINTAIN PRODUCTION BASE FOR ESSENTIAL CONSUMABLES
- QUALITY U.S. EQUIPMENT FOR FOREIGN MILITARY SALES
- MAINTAIN WARM BASE IF FUNDS AVAILABLE
- REDUCE LIFE CYCLE OPERATIONS SUPPORT COSTS

– – –BALANCED TOTAL FORCE WITH HIGH – LOW MIX

STRATEGY – TECHNOLOGY – FISCAL

ACQUISITION PRINCIPLES

General WAGNER. Mr. Chairman and members, as we take the doctrine and the guidance that we get from the user on what the Army needs we have certain acquisition principles that apply as we put our programs together in the Army. This is to ensure that we have as balanced a program within given funds available as possible. I need to cover a little bit of the background on how we came up with our aviation program so you will understand the problems we faced when we tried to squeeze more than we can afford into the bag.

First of all, we do base our equipment on the doctrine. We have to keep a research and development program going to make sure that we keep ahead of the threat. I am going to discuss that a little more later.

MOBILE SUBSCRIBER EQUIPMENT

We attempt, if possible, to buy at economic rates and to get in and get out. What I mean by this is if we can afford it in a budget and we have deficiencies, it is a good idea to buy it as quickly as we can to save the inflation dollars if you spread it over many years. A good example of this is the mobile subscriber equipment [MSE] that we are buying over a period of 5 to 6 years and deploying it throughout the entire Army and the Reserve components.

We have also done that in ammunition items frequently where we attempt to buy everything in 1 year at high rates in the most economic fashion. For example, this year we are buying illuminating rockets and will not buy any more for 5 or 6 years for aircraft. We are buying 60 millimeter mortar ammunition and will not buy any more for 5 years.

SPARES

We need to maintain a production base for consumables. That is the spares. Even though we buy the main item over 5 or 10 years, we often keep it in the inventory 20, 25, or 30 years in the case of aircraft, so we have to make sure that we keep a hot production line for spares. That does not necessarily mean that it is the production line of the manufacturer of the airframe, because there are other companies that manufacture spare parts.

SALES TO FOREIGN PARTNERS

If we are going to be active in the foreign military sales arena and if we want to balance what we buy offshore by selling onshore, we have got to be willing to sell first-rate equipment to our friends and allies throughout the world. We attempt to do that, and also that helps us in balancing our production rates. When our numbers drop, if we can put in FMS sales we can help get a high production rate and save everyone money.

We attempt to maintain warm production bases if we can afford it. We are going to see some today, however, where we feel with the dollars available we cannot afford it you will see that those programs are dropped.

REDUCING LIFE CYCLE COSTS

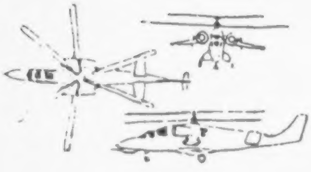
Finally, we are putting a lot of emphasis today on reducing life cycle costs both in the development of new programs and also as we product improve our equipment. We are putting a lot of emphasis on improvements to reduce the costs of operating in peacetime. When wartime comes, we understand we have to operate it, but the largest costs over a 20- or 30-year life cycle of a piece of equipment are in peacetime. So we attempt to get those costs down.

Finally, we can never afford to outfit our entire Army with the latest equipment, so we always have the high side, with the best equipment for those that fight first, and a lower side with that older equipment that would fight later in the war.

We base our acquisition on the strategy of our country, the technology available, and, unfortunately, the fiscal realities, because that drives us and we have to balance our budget.

HELICOPTERS

THREAT DRIVES R & D



- HIGHER SPEED
- IMPROVED ANTI-ARMOR MISSILE
- AIR-TO-AIR MISSILE
- ADVANCED TARGET ACQUISITION
- BALLISTIC PROTECTION
- NIGHT-ADVERSE WEATHER CAPABILITY

- IMPROVED SURVIVABILITY
- GREATER LETHALITY
- HIGHER SPEED
- NIGHT-ADVERSE WEATHER CAPABILITY
- GREATER SORTIE GENERATION
- SIMPLIFIED MAINTENANCE

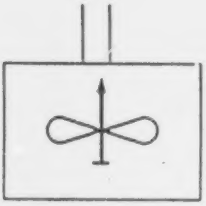
HELICOPTERS THREAT

General Wagner. Take, for example, helicopters. If you look at the threat today you will find that the Soviets are developing modern helicopters as good as and, in some cases, believed to be in the near future better than the helicopters that we are fielding today. They have taken the lead from the United States, which was the leader in attack helicopters and they are developing a much greater capability in some of the areas you see on the chart than we have ever had.

So we have to then look into our technology base and into our R&D program to see what do we have to do to counter that threat. One of the programs I am going to discuss today is the LHX helicopter, which will counter those Soviet threats that are improving all the time.

THE AH-64 BATTALION IS MORE THAN 18 AIRCRAFT

AH-64 BATTALION



264 PERSONNEL

AIRCRAFT	ASSOCIATED EQUIPMENT	OPERATING COSTS	WAR RESERVES
$222M	$300M	$25M	$6M

TOTAL $553

NO POMCUS

MODERNIZING COSTS

General WAGNER. Many people believe that the total cost involved with modernizing our Army is the cost only of the end item. For example, if I want to buy a battalion's worth of AH–64 Apache helicopters, it will cost me about $222 million. But if I want to field that unit into a new battalion to put out in the field, it is going to cost me another $300 million for the associated equipment that goes into that battalion, plus the operating costs for 1 year and the war reserves, which means the ammunition in this case and the spares, for a period of time which is classified so that we can put it into combat. We then come up with a total of about $553 million.

That is normal in all of our programs. The cost of the end item is usually less than half of the total amount of dollars required to field a battalion. Now that is not to say that to field any new battalion would cost that much because if we are replacing an older item there are some of the items that can be retained. However, on average it is somewhere between the $222 million and the $553 million.

FY88 – 89 ARMY BUDGET SUMMARY
(TOA IN $ BILLION)
[WITH SUPPLEMENTAL]

APPROPRIATION CATEGORIES	1987	1988	1989
MILITARY PERSONNEL	28.3	29.2	29.3
OPERATIONS AND MAINTENANCE	23.1	24.8	26.7
MILITARY CONSTRUCTION	3.3	3.4	3.6
[RESERVE COMPONENTS]	[7.8]	[8.3]	[8.6]
STOCK FUND (WAR RESERVES)	.1	.3	.4
SUBTOTAL	54.8	57.7	60.0
BALANCED BY:			
PROCUREMENT	15.9	16.2	16.6
RDT&E	4.8	5.5	6.0
TOTAL	75.5	79.4	82.6

ARMY BUDGET SUMMARY

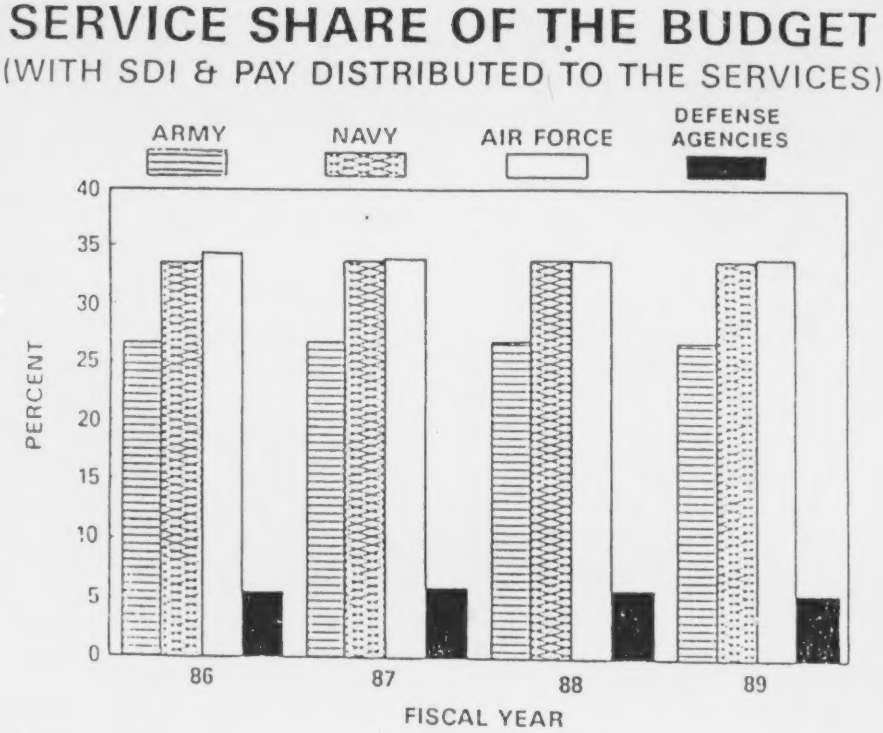
General **Wagner**. Now, what is driving us in this year's program and in every year's program is the budget dollars available to the Army. I have broken out here for 1987, 1988, and 1989 the various appropriation categories. I want to show you that we do not have a lot of latitude in the investment accounts.

For example, military personnel is flat. We have made a decision that the force structure of the Army is going to remain flat, and we have held it there for about 5 years—a good decision.

Operations and maintenance costs go up because as we field new equipment and flow down the old equipment to the Reserve components and the National Guard, they operate it more and we also have to operate the newer equipment, so your operations and maintenance costs go up some.

Military construction is relatively flat. I have shown here in brackets the amount of dollars that are included in these categories that are going into our Reserve components because it is a total Army and our accounts cover both the Reserve and the active components. Finally, we have the stock fund.

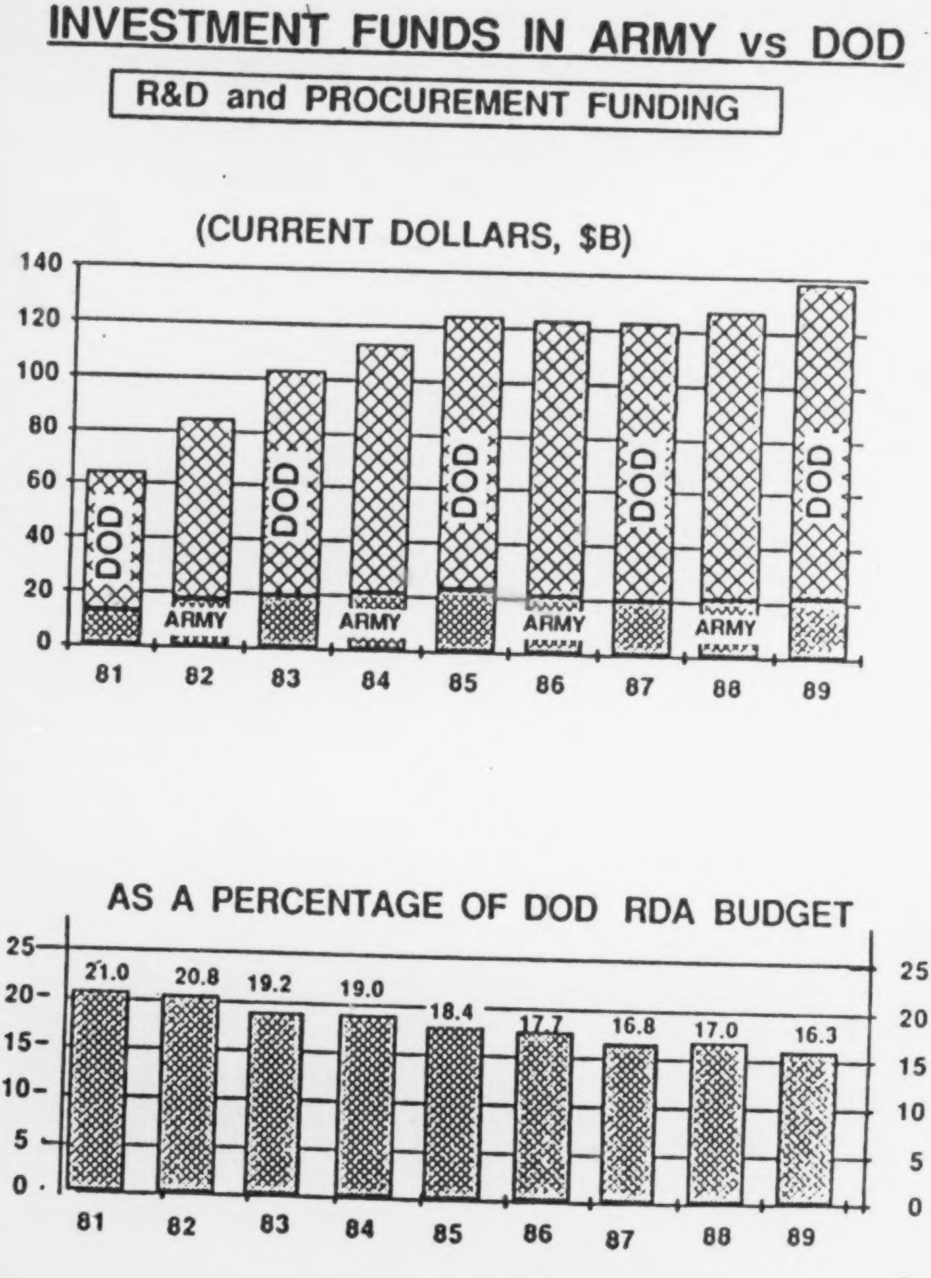
This is the part that we are going to be discussing today in some more detail—specifically, about $21 billion to $22 billion a year in R&D and in procurement.



	86	87	88	89
ARMY	26.5	26.5	26.7	26.8
NAVY	33.6	33.4	33.5	33.8
AIR FORCE	35.6	33.9	33.6	33.6
DEFENSE AGENCIES	4.3	6.2	6.2	6.1

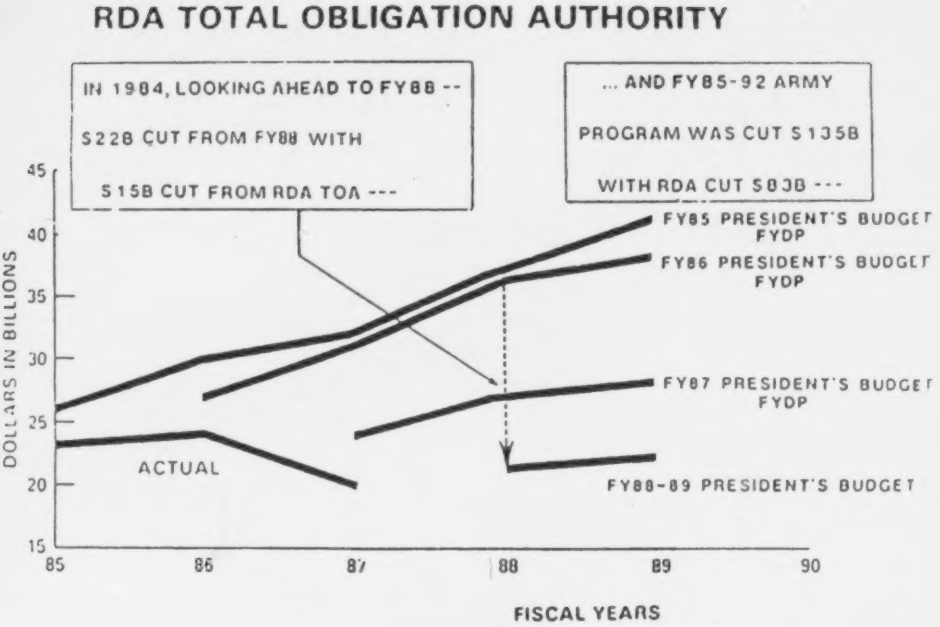
SERVICE SHARE OF THE BUDGET

General WAGNER. Now where do we stand as far as the Department of Defense is concerned? If you take the total dollars available for the Department of Defense you will find that the Army's share averages about 26-plus percent per year. If you go back as long as I can remember, 10 or 15 years, it varies from 24 to 27 percent, but overall has been relatively standard as far as a total TO&A dollars available to the Army.



ARMY VERSUS DOD FUNDS

General WAGNER. The problem we are facing in the Army now, however, is while we are getting a standard percentage of the DOD budget, the amount that is available to us in the investment accounts has gone down. For example, in 1981 we were getting 21 percent of the RDA investment dollars in the Department of Defense. Now, because of our fixed costs in the Army—and we are a manpower-intensive service—that percentage has dropped down to about 16.3 percent.



RDA TOTAL AUTHORITY

General WAGNER. In addition to that we program for equipment over a 5- to 10-year period. I would have to admit that the estimates that we have been using in the Department of Defense have been too optimistic, and as a result we had a program growth that we are not going to get. For example, in the period from 1984 to 1988 we cut out of the Army program $22 billion and $15 billion of that was in RDA, because that is the account where we have some latitude.

From 1985 to 1992 we have had to take out of the total Army program $135 billion because of the deficit and other problems, and $83 billion of that came out of our RDA budget. So we just cannot afford everything we need.

AND NOW --- FOCUS ON PROCUREMENT FY88-89

PROCUREMENT	FY87	FY88	FY89
TOA ($B)	15.9	16.2	16.6
RDTE			
TOA ($B)	4.8	5.5	6.0
RDA (TOTAL)			
TOA ($B)	20.7	21.7	22.6

PROCUREMENT COSTS

Chairman STENNIS. How much was that in what time?

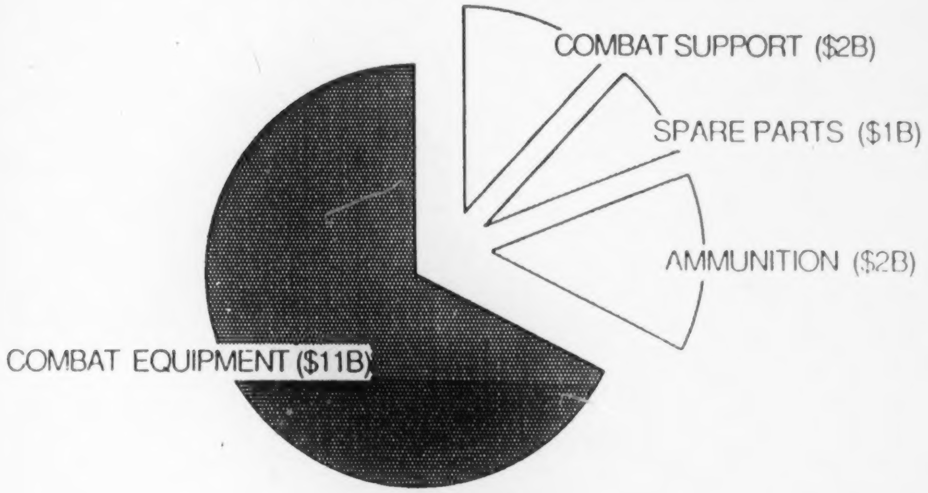
General WAGNER. That was in a period of 7 years—$135 billion out of the Army and $83 billion out of research, development and acquisition.

Chairman STENNIS. All right. Go ahead.

General WAGNER. We are going to zero in now on our procurement account, which runs about $16 billion a year during the period 1987–89. I point out that it was over $18 billion in the 2 preceding years.

FIXED PROCUREMENT COSTS

(FY 88 BUDGET--$16 Billion)



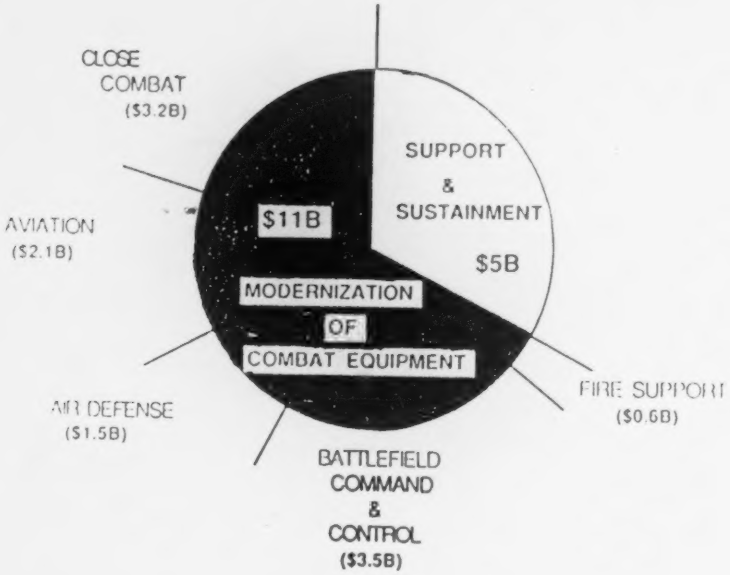
COMBAT SUPPORT EQUIPMENT

General WAGNER. Now, we would like to believe that the total amount was available to buy combat equipment, aviation, for example, but it is not because we have fixed costs that we have to deal with. For example, every year in the combat support arena we have to spend about $2 billion. That is the trucks, the test equipment, everything we need to operate those items on the battlefield.

Second, spare parts make up about $1 billion a year. There are two parts in that—replenishment spares that we use every day and wartime spares. Finally, ammunition, both training and wartime reserves, is about $2 billion a year, which leaves $11 billion to buy new equipment.

PROCUREMENT AVAILABLE FOR MODERNIZATION

(FY88 BUDGET--$16 Billion)



CLOSE COMBAT ITEMS

General Wagner. Now how do we break that up? Very basically we break it up into close combat—that is your tanks, your Bradleys, things of that nature—aviation, air defense, command and control and fire support. Aviation is the part that we are going to be talking about today.

MODERNIZATION STRATEGY
KEYED TO AIRLAND BATTLE

REAR

BLACKHAWK HELICOPTER•
CH-47 HELICOPTER•
PATRIOT•
RECOVERY VEHICLE
HIGH MOBILITY MULTI-PURPOSE WHEELED VEHICLE•
FAMILY OF MEDIUM TACTICAL VEHICLES•
HEAVY EXPANDED MOBILITY TACTICAL TRUCK

CLOSE

M1 TANK•
BRADLEY•
APACHE HELICOPTER•
HELLFIRE•
HOWITZER IMPROVEMENT
LIGHT HOWITZER
FORWARD AREA AIR DEFENSE•
TOW•
COMBAT EARTHMOVER
COPPERHEAD
NIGHT VISION•

DEEP

MULTIPLE LAUNCH ROCKET SYSTEM (MLRS)•
MLRS TERMINALLY GUIDED WARHEAD
ARMY TAC MSL SYS
JT SURV & TGT ATK RADAR SYS (JOINT STARS)
AQUILA REMOTELY PILOTED VEHICLE•
JT TAC FUSION (ASAS)
SOF AIRCRAFT•

ARMY COMMAND/CONTROL SYSTEM (ACCS)

AFATDS FAAD C2I CSSCS MCS ASAS

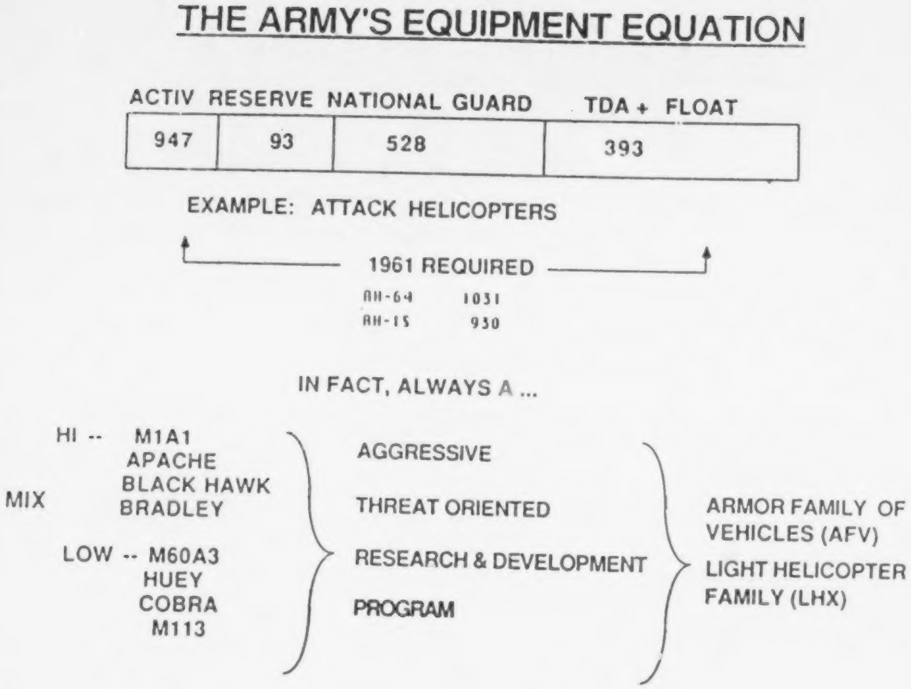
- MANEUVER CONTROL SYS (MCS)•
- MOBILE SUBSCRIBER EQUIP (MSE)•
- FORWARD AREA AIR DEFENSE C2I
- ARMY DATA DISTRIBUTION SYS (ADDS)•
- SINGLE CHANNEL OBJ TAC TERMINAL (SCOTT)
- ADV FLD ARTILLERY TAC SYS (AFATDS)
- SING CHNL GRND/ABN RADIO SYS (SINCGARS •
- JOINT TAC COMMO PRGM (TRI-TAC)•

* 20 SYSTEMS = 70% FOR MODERNIZATION

MODERNIZATION STRATEGY

General WAGNER. The Army is sometimes harder to understand than the other services, primarily because we have so many systems and we have to be prepared to fight a rear, a close, and a deep battle, as General RisCassi pointed out. Undergirding all that are the command and control systems so we can control that battle. We are increasing dollars in that area considerably.

Finally, if you look at the asterisk items you will find that they make up 70 percent of the total of the $11 billion we have for procurement in any given year. So again we have to divide it among those items primarily, and as a result we have little latitude on the outside.



THE ARMY'S EQUIPMENT EQUATION

ACTIV	RESERVE	NATIONAL GUARD	TDA + FLOAT
947	93	528	393

EXAMPLE: ATTACK HELICOPTERS

1961 REQUIRED

AH-64 1031
AH-1S 930

IN FACT, ALWAYS A ...

MIX
HI -- M1A1
APACHE
BLACK HAWK
BRADLEY
LOW -- M60A3
HUEY
COBRA
M113

AGGRESSIVE
THREAT ORIENTED
RESEARCH & DEVELOPMENT
PROGRAM

ARMOR FAMILY OF VEHICLES (AFV)
LIGHT HELICOPTER FAMILY (LHX)

EQUIPPING THE FORCES

General Wagner. Now let us look at the Army's equipment equation. When we come up with a requirement for a piece of equipment we have to look at filling up our Active Forces, our Reserve component forces, the National Guard, the training establishment, and the float requirement in our maintenance battalions.

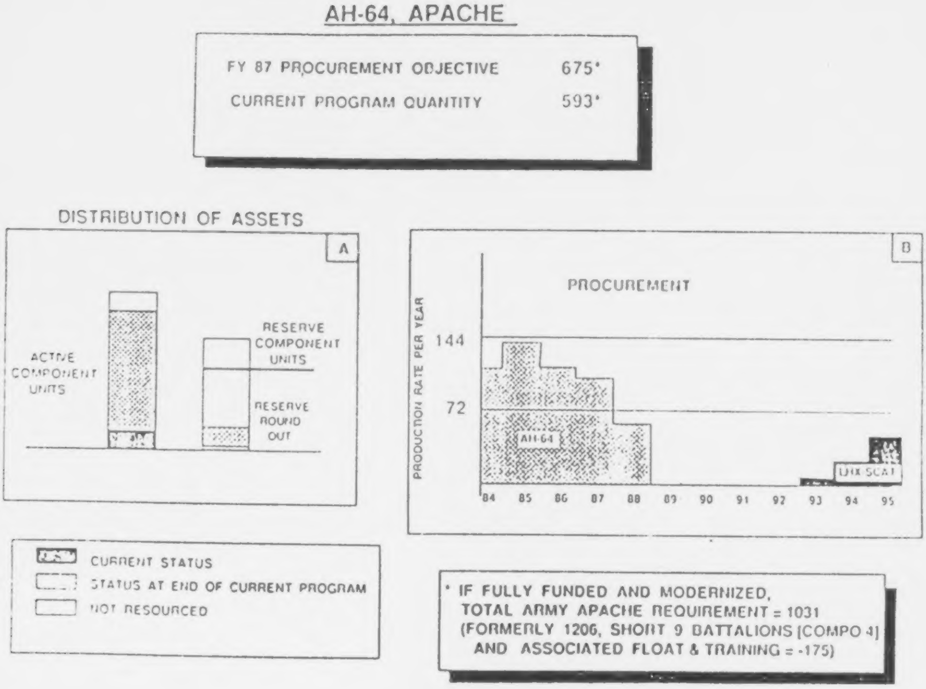
In the case of aviation we do not have war reserves. In the case of tanks and some other pieces of equipment, we do have war reserves. If you look at the total number of attack helicopters we need, for example, it comes to 1,961, made up of two parts—the AH–64, which is the high side with a total requirement, given that we had all the funding available, for 1,031. On the low side we use the AH–1S attack helicopter. In fact, in some of our lowest priority units we have even had the UH–1M, which was a Huey model used in the Vietnam war, but that is coming out of our inventory.

The facts of fiscal reality mean that we are always going to have a high-low mix, as I pointed out before. On the high side we are going to have the Apache and the Blackhawk, while on the low side we are going to have the Huey and the Cobra. However, we have to keep research and development going so that we can come up in the future with a replacement for a lot of our older helicopters.

Senator Johnston. Excuse me, Mr. Chairman. Would you explain what you mean by high and low? I missed something.

General WAGNER. Yes, sir; the high side of our forces are those forces that deploy early. In other words, we look at the high side primarily as those that we would like to have in Europe to fight in the early days of the war, generally considered 10 divisions. The low side are those later-deploying units that probably would not deploy before up to 90 days or even later after the war began.

On the high side it is first basically your Active Forces and the roundout forces that we have in our Reserve components and the National Guard. Those roundout forces go from the day the war starts and they are, incidentally, filled at the same time their active division is filled. The lower side then are those late-deploying units and it is there that the equipment flows down to as we get new equipment into the inventory.



AH-64, APACHE

FY 87 PROCUREMENT OBJECTIVE 675*

CURRENT PROGRAM QUANTITY 593*

* IF FULLY FUNDED AND MODERNIZED, TOTAL ARMY APACHE REQUIREMENT = 1031 (FORMERLY 1206, SHORT 9 BATTALIONS [COMPO 4] AND ASSOCIATED FLOAT & TRAINING = -175)

APACHE

General WAGNER. What I would like to do now is cover with you three of our major aviation programs, and I am going to use a series of charts here that will explain to you the problem we are up against and how we have laid out what we believe is a balanced program.

APACHE HELICOPTRS

First of all, the top block will always show you what our procurement objective was last year and what the current program quantity is. If you come down to this corner you will see what our total requirement is if we had unlimited dollars. As I pointed out on the previous chart, that is 1,031 Apache helicopters.

I would like to lay to rest right now a number 1,206 that you see in the newspapers and so forth as to the requirement for the Apache helicopter. That is the requirement if we were going to fill what we call compo-IV units, which are unmanned. It makes no sense to buy equipment for units that we cannot man, so we are cutting those out and that should not be part of the requirement.

GUARD AND RESERVE UNITS

Senator DECONCINI. Mr. Chairman, may I just ask a question? Does that include Guard and Reserve in that unmanned unit?

General WAGNER. That includes some of the Guard. Some of those would be Guard and Reserve units, yes, sir. It is not Guard and Reserve units that are active today. I believe that is right.

Senator DECONCINI. Thank you, Mr. Chairman.

General WAGNER. In block A in each case you will see what our current fill is, what our fill will be at the end of the program—that means 593 in the case of the Apache—of our Active Forces, and you will see that we come up pretty close to the top of the Active Forces we planned on filling. We have filled, however, only a portion of our Reserve roundout, and none of those Reserve units other than roundout.

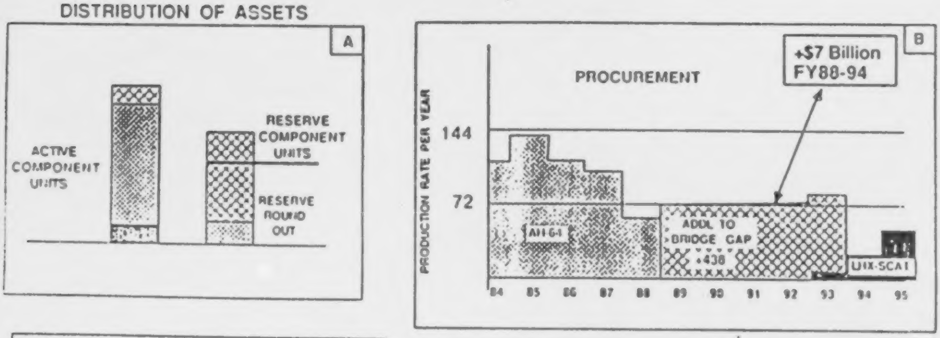
If you go to the chart B in each case on these charts you will see that we are showing you what the program has been from 1984 through the current budget submission, and you will see that the AH-64 went up to a high production rate of 138 in a year and will be dropping in 1988 down to about 67. We will then be closing that production line down with the current dollars we have available.

The LHX-SCAT helicopter,which will be coming on later, will start production in 1993 and build to a greater rate in 1995.

Now if we had more dollars available, what would we do with them?

AH-64, APACHE -- BRIDGING THE GAP

FY 87 PROCUREMENT OBJECTIVE	675*
CURRENT PROGRAM QUANTITY	593*
EXTENDED QUANTITY TO BRIDGE GAP	1031*

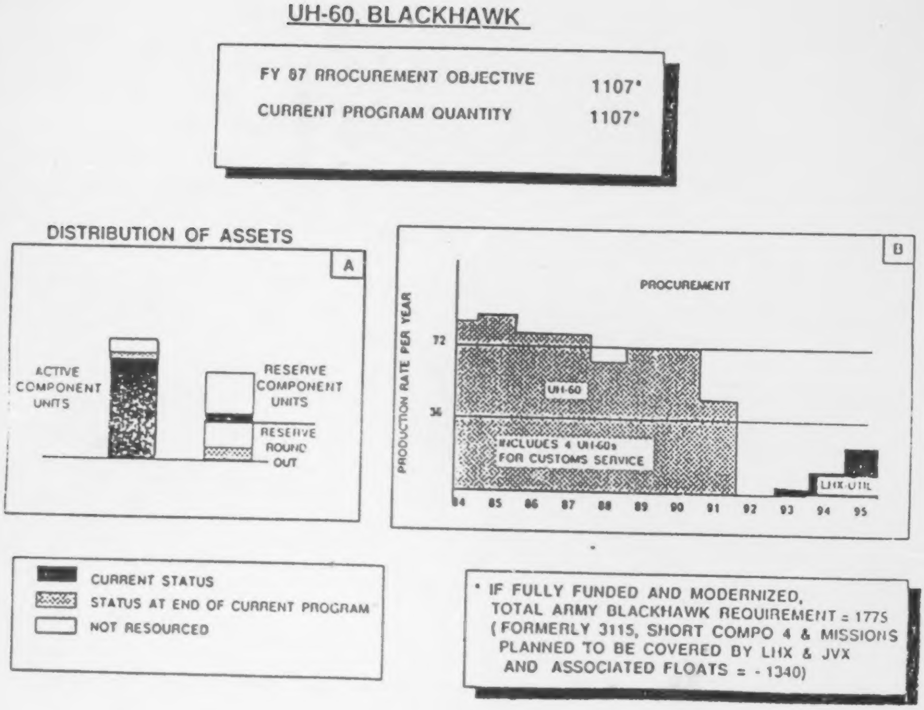


▨ CURRENT STATUS
☐ STATUS AT END OF CURRENT PROGRAM
☐ NOT RESOURCED
▨ EFFECT OF GAP BRIDGING QUANTITY

* IF FULLY FUNDED AND MODERNIZED,
TOTAL ARMY APACHE REQUIREMENT = 1031
(FORMERLY 1206, SHORT 9 BATTALIONS (COMPO 4)
AND ASSOCIATED FLOAT & TRAINING = -175)

AH-64, APACHE PRODUCTION

General Wagner. We would bridge that gap between the production of the AH-64 and the SCAT by building at the minimum economic rate of 72 a year. That would give us the capability of producing through 1993 funded delivery period—they would actually be delivered in 1995. An additional 438 aircraft would fill our total quantity required and, as you can see, would fill out our active components and all the Reserve components and roundout units that were scheduled to get that helicopter.



UH-60, BLACKHAWK

FY 87 PROCUREMENT OBJECTIVE 1107*
CURRENT PROGRAM QUANTITY 1107*

* IF FULLY FUNDED AND MODERNIZED, TOTAL ARMY BLACKHAWK REQUIREMENT = 1775 (FORMERLY 3115, SHORT COMPO 4 & MISSIONS PLANNED TO BE COVERED BY LHX & JVX AND ASSOCIATED FLOATS = - 1340)

UH-60, BLACK HAWK

Chairman STENNIS. General, pardon me a minute. I wish we could give you more time, but we have got other matters, as you know. About how many more minutes do you need?

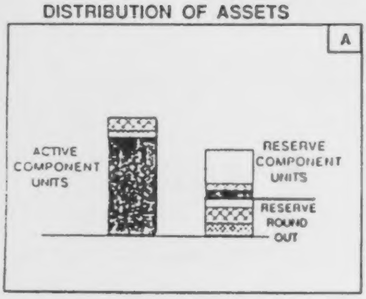
General WAGNER. About 3 more minutes.

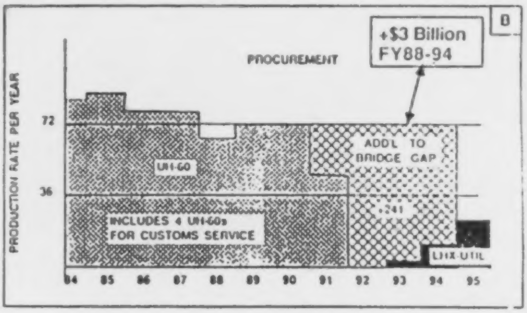
Chairman STENNIS. Go ahead.

General WAGNER. We are going to look at two more helicopters. Looking in the same fashion at the UH-60 Black Hawk, our requirement program quantity today is 1,107. If we had all the TOA we required we could use 1,775. This chart again shows that we are not quite up to our active component fill today, and our roundout is partially filled. Some Reserve component units are getting the Black Hawk that are not in roundout.

UH-60, BLACKHAWK --- BRIDGING THE GAP

FY 87 PROCUREMENT OBJECTIVE	1107*
CURRENT PROGRAM QUANTITY	1107*
EXTENDED QUANTITY TO BRIDGE GAP	1348*





▪ CURRENT STATUS
▨ STATUS AT END OF CURRENT PROGRAM
☐ NOT RESOURCED
▩ EFFECT OF GAP BRIDGING QUANTITY

* IF FULLY FUNDED AND MODERNIZED,
TOTAL ARMY BLACKHAWK REQUIREMENT = 1775
(FORMERLY 3115, SHORT COMPO 4 & MISSIONS
PLANNED TO BE COVERED BY LHX & JVX
AND ASSOCIATED FLOATS = - 1340)

ADDITIONAL HELICOPTER PURCHASE

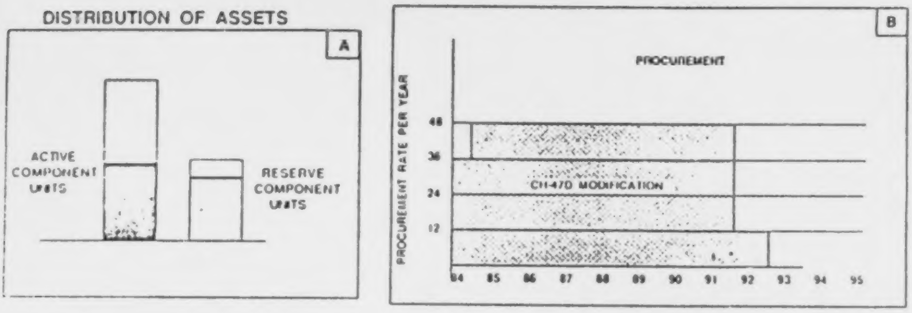
General WAGNER. If we bridge this gap and bought an additional 241 helicopters, we would not reach the 1,775. We would bridge the gap in production. We would fill up the Active Forces, begin to fill some more of our Reserve components.

CH-47D CHINOOK

General WAGNER. Finally, looking at our CH-47D Chinook helicopter, this is a little bit different situation. This is a conversion program. We have got 472 airframes out there. We are funded to convert 436 of those. It fills up everything but about one or two Reserve component units.

CH-47D, CHINOOK

FY 87 PROCUREMENT OBJECTIVE 436*
CURRENT PROGRAM QUANTITY 436*



▨ CURRENT STATUS
▭ STATUS AT END OF CURRENT PROGRAM
▭ NOT RESOURCED

* IF FULLY FUNDED AND MODERNIZED,
TOTAL ARMY CHINOOK MODIFICATION = 472
(TOTAL REQUIREMENT = 545, BUT ONLY 472
AIRFRAMES ARE AVAILABLE FOR MODIFICATION)

General WAGNER. If we converted those additional 36 aircraft for $0.2 billion, we could fill up the additional part of that Reserve component and meet our requirement of 472. The total requirement is higher than that, and we used our old CH-54 helicopters to fill that.

Now you have noticed on these charts that this is not free. It costs $7 billion, for example, to fill that gap if we continue production of Apaches over the next few years, and $3 billion on the other aircraft.

ARMY'S FY88-89 RDTE SNAPSHOT ---

($B)

BUDGET ACTIVITY	FY87	FY88	FY89
TECHNOLOGY BASE	.9	.8	.9
ADVANCE TECH DEVELOPMENT	.4	.4	.4
STRATEGIC PGMS	.2	.1	.1
TACTICAL PGMS	2.1	2.9	3.3
INTELLIGENCE & COMMO	.1	.1	.1
DEFENSE WIDE MISSION SUPPORT	1.1	1.2	1.2
TOTAL	4.8	5.5	6.0

RDTE DOLLARS

General WAGNER. Looking at our R&D base now, these are the R&D programs and you see the majority of our dollars are in tactical programs.

THE HEART OF R&D --- TACTICAL PROGRAMS

($ MILLIONS)

TACTICAL PROGRAMS

FY87	FY88	FY89
2051	2882	3264

	FY87	FY88	FY89
AIRCRAFT	140	460	664
AIR DEFENSE	90	147	185
ARMOR	126	158	139
SPECIAL OPERATIONS FORCES	43	115	52
COMMO	159	228	263
MISSILES	209	276	302

THE FUTURE THRUSTS		
ANTI ARMOR WEAPONS	TACTICAL MISSILES	COMMAND & CONTROL
ARMOR FAMILY OF VEHICLES	JOINT STARS	ADVANCED MUNITIONS
FORWARD AREA AIR DEFENSE	JOINT TACTICAL FUSION	ADVANCED HELICOPTERS

FUNDING OF HELICOPTER PROGRAM

General WAGNER. The heart of that in 1988 you can see is aviation, the highest number of dollars going into that program.

LHX → WHY LHX?

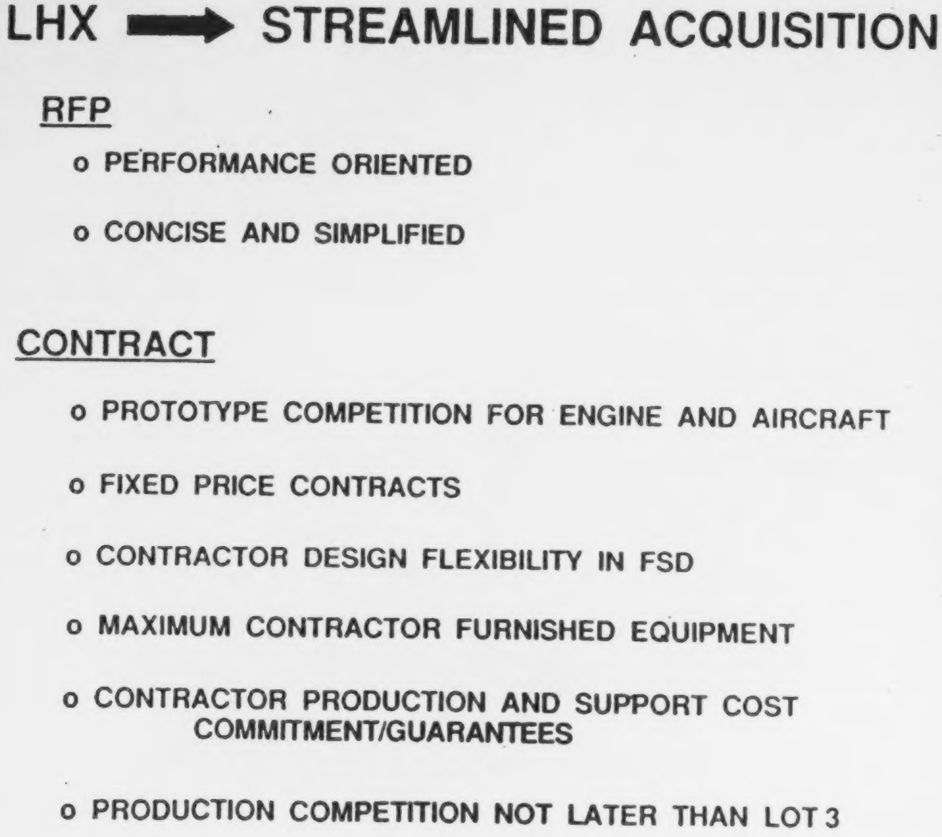
EXISTING LIGHT FLEET (AH-1, UH-1, OH-58) MAJOR DEFICIENCIES

- THIRTY YEARS OLD/TACTICALLY OBSOLETE
- CAN'T FIGHT EFFECTIVELY AT NIGHT OR IN ADVERSE WEATHER
- MARGINALLY SUPPORTABLE
- LITTLE OR NO PAYLOAD IN MIDDLE EAST
- NO AIR-TO-AIR CAPABILITY
- NO SELF-DEPLOYMENT CAPABILITY
- NOT SURVIVABLE ON TOMORROW'S BATTLEFIELD

DEMAND LHX

LHX

General WAGNER. And our key program is the LHX. We are going to be answering questions on this today, so I just want to hit a few high points on it. Very basically we are replacing old aircraft that are very difficult to maintain any more. They cannot fight effectively on the battlefield, and they have no night capability and basically no air-to-air capability. They are basically not survivable and 80 percent of our helicopters fall into that category today.



LHX → STREAMLINED ACQUISITION

RFP

- o PERFORMANCE ORIENTED
- o CONCISE AND SIMPLIFIED

CONTRACT

- o PROTOTYPE COMPETITION FOR ENGINE AND AIRCRAFT
- o FIXED PRICE CONTRACTS
- o CONTRACTOR DESIGN FLEXIBILITY IN FSD
- o MAXIMUM CONTRACTOR FURNISHED EQUIPMENT
- o CONTRACTOR PRODUCTION AND SUPPORT COST COMMITMENT/GUARANTEES
- o PRODUCTION COMPETITION NOT LATER THAN LOT 3

LHX ACQUISITION

General Wagner. We are looking at some streamlined acquisition on this. For example, we are already out with our RFP on the engine, which is the shortest one in history. We are telling the engine manufacturer you build it to meet specifications and we will buy if it is effective, and that program is working very well and is cost effective.

We want prototype competition. We want to have contractor production and support costs commitments and guarantees up front, and finally we want to make sure that we have production competition no later than lot 3, which is early on in the production, to get the cost down.

LHX → PUTTING TECHNOLOGY TO WORK

SINGLE PILOT

- INTEGRATED AUTOMATED COCKPIT
- DIGITAL MAP
- VOICE INTERACTIVE AVIONICS
- ADVANCED FLIGHT CONTROLS
- DEMONSTRATE THROUGH SIMULATION

PERFORMANCE

- LIGHTWEIGHT COMPOSITES
- ADVANCED TECHNOLOGY ENGINES
- FLY-BY-LIGHT CONTROL SYSTEM
- INTEGRATED ROTOR SYSTEM
- LOW DRAG DESIGN

ACQUIRE/KILL/SURVIVE

- ADVANCED FLIR
- HELMET MOUNTED DISPLAY
- OFF-AXIS ACQUIRE & ENGAGE
- VHSIC PROCESSORS
- IMPROVED BALLISTIC PROTECTION
- ENHANCED SURVIVABILITY FEATURES

SUSTAIN

- SCAT UTILITY COMMONALITY
- ON BOARD DIAGNOSTICS/PROGNOSTICS
- MINIMAL SUPPORT EQUIPMENT
- TWO LEVEL MAINTENANCE
- AUTOMATED PUBLICATIONS
- COMPUTERIZED SUPPLY SYSTEM

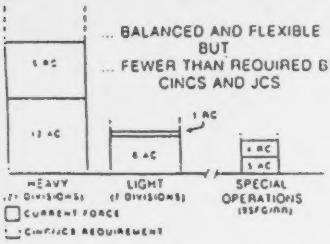
SINGLE PILOT PROGRAM

General WAGNER. We say we are ready to go to full-scale development on the LHX. First of all, we have active programs going to test whether we can get by with a single pilot, and we will make that decision by 1993. If we can, there are significant savings. In any case, the avionics we need are necessary whether it is a single pilot or two pilots.

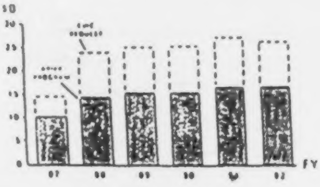
Finally, we have composite aircraft flying. We have aircraft flying by light—that means fiberoptic cables—today and we have all of these other systems proven. We are working on our aided target recognition. It is ready to go into full-scale development. And finally we are working very hard to make sure that it is a fully sustainable aircraft on the battlefield.

BALANCE ACROSS THE ARMY

FORCE TO BE MODERNIZED...



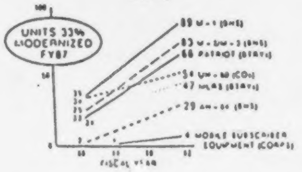
SUPPORT OF CINC REQUIREMENTS



MANPOWER

ACTIVE	781,000
RESERVE COMPONENT	781,000
CIVILIAN	412,000

UNIT MODERNIZATION



READINESS,
SUSTAINABILITY, MODERNIZATION, FORCE STRUCTURE

BALANCING THE FORCE

General **Wagner**. Mr. Chairman, we have done our best to balance our forces in the U.S. Army. We have to look at force structure. We have to look at supporting our CINC's in the field. We provide about 60 to 80 percent of what they ask for. We have to look at our manpower and finally we have to look at modernization. It is very difficult to balance all of those, but we do the best in the Army that we can to do that.

We are ready for your questions.

[The prepared statement of Generals Wagner and RisCassi and the accompanying slides follow:]

PREPARED STATEMENT OF LT. GEN. LOUIS C. WAGNER, JR.

DEPUTY CHIEF OF STAFF FOR RESEARCH, DEVELOPMENT AND ACQUISITION

Mr. Chairman, members of the subcommittee, our briefing will address the President's FY 88 Budget Request for Army Aviation with emphasis on the rotary wing portion.

INTRODUCTION.

In order to fully understand the Army Aviation program, it is necessary to review the development of Army requirements. The Army's concept-based requirements system (CBRS) uses assigned Army missions, the threat, historical perspectives, technological forecasts and battle doctrine to arrive at an approved "how-to-fight" concept. This process also establishes an approved battle concept for each mission area (close combat, aviation, air defense, etc.). The capability to implement each mission area concept is dependent upon resources. When inadequate resources create deficiencies in these concepts solutions are sought beginning with the lowest cost option, a change to doctrine; then considering changes to training and force structure, or finally the modification or procurement of new equipment.

THREAT.

As mentioned earlier the threat influences our concept based requirements system and hence our doctrine, training, force structure and new equipment. To better understand the profound improvement in Soviet attack helicopter capabilities a short review of the past is essential. The tremendous success of the helicopter during the Vietnam war created a helicopter development race among the industrial nations of the world. This explosion of industrial activity was fueled by the realization that the helicopter, and in particular the attack helicopter, had become one of the most formidable weapons systems on the conventional battlefield. Alarmingly, the Soviets studied and rapidly developed a remarkable attack helicopter capability. Fourteen years ago the U.S. emerged from Vietnam as the world's leading developer of helicopters and the leader in helicopter doctrine. The Soviets at that time had just begun attack helicopter fielding with the HIND A. However, by the mid-1980's they had refined the HIND D to a point that it had more firepower, airspeed and survivability than the AH-1S. The Soviets have outproduced the U.S. in numbers of attack helicopters, and with the HAVOC and HOKUM they will soon have a substantial increase in capability. Soviet helicopter forces are similar to U.S. helicopter forces. They are organic to ground forces and are assigned in Helicopter Regiments at Front and Army levels and in Helicopter Squadrons and Regiments at Squadrons/ Detachments at Division level. Employment techniques and doctrine of Soviet attack helicopter units differ from the U.S. in that they are employed in a close air support role for ground forces while we capitalize more on integrated maneuver, terrain flight and nap-of-earth fighting techniques. Assessment of how the Soviets will employ HAVOC and HOKUM shows that their anti-armor and air to air capabilities are increasing. U.S. Army Aviation is currently deficient in the air to air combat mission area against the Soviet attack helicopters. We are currently outnumbered by about 1.6 : 1, and if our data is correct that figure will increase to nearly 2 : 1 by 1995. More importantly, however, is the fact that the Soviet attack helicopters possess a greater air-to-air combat capability than our current fleet. Our helicopters (AH-1S, AH-64) are optimized for antiarmor and terrain flight while the Soviets have opted for more speed, rapid-fire cannons with good air-to-air application, and anti-tank missiles that have fairly good application in helicopter air-to-air combat. U.S. Army Aviation is embarked on a program to protect the helicopter force from this threat. We have just completed the Air-to-Air Combat 1 (ATAC 1) test and plan to train aircrews for proper actions in the event of helicopter engagement in the near term. We will field Stinger on 2100 of our helicopters and fix the cannon solution on AH-1S and AH-64 in the midterm, and will field the LHX with a substantial air-to-air capability in the far term.

DOCTRINE

Current and future Army concepts are based on AirLand Battle (ALB) doctrine. ALB includes both the operational and tactical levels of warfare. It is a change in doctrine from the war of attrition based concept that served the Army well in the past. The need for such a change is obvious--resources will not allow the U.S. to match the enemy item for item in quantity. Therefore, ALB is based on securing and retaining the initiative and exercising it aggressively. To do this, we must throw the enemy off balance with a powerful blow from an unexpected direction, follow-up rapidly to prevent his recovery and continue operations to achieve our purposes. Success of ALB is dependent on the Army's ability to fight in accordance with four basic tenets: initiative, agility, depth and synchronization. As previously mentioned, intiative means setting or changing the terms of battle by action. Agility is the ability to act faster than the enemy and is a prerequisite for seizing and holding the initiative. Depth applies to the extension of operations in space, time and resources. Depth gives our forces adequate maneuver area, planning time and resources to win. Synchronization is the arrangement of battlefield activities in time, space and purpose so as to produce the maximum relative combat power at the decisive point (right force, right location, right time).

Army Aviation is the most flexible and responsive of the combat arms. It embodies the tenet of agility and is the key combat multiplier that allows commanders to break "ground friction" in combat. Army aviation's agility provides rapid and violent reaction to threat initiatives and contributes heavily in gaining or retaining the initiative. Aviation agility is equally important in achieving depth and synchronization. It destroys enemy forces using maneuver to concentrate and sustain combat power at the critical time and place. As a fully integrated member of a combined arms team, aviation accomplishes this by:

- Aerial attack of armor targets.
- Air assault of troops or air movement of equipment and supplies.
- Rapid logistical resupply.
- Air-to-air operations.
- Command, control and communications support.

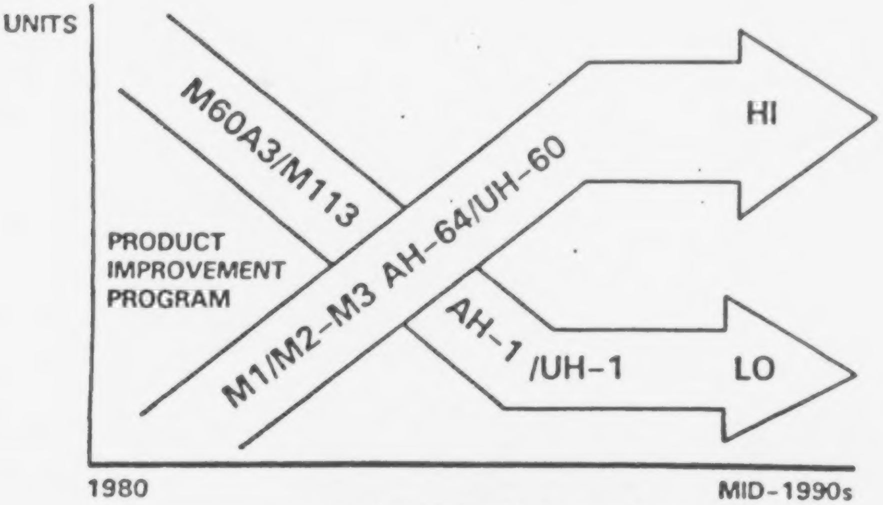
The role of aviation in Army combat doctrine has grown immensely in a short period of time. It is this increased role for aviation that drives our modernization efforts.

During the early seventies, the results of the Howze Board and Ansbach tests, coupled with the Army's Vietnam combat experience, revolutionalized how we employed aviation and provided the impetus toward a combined arms concept with aviation as an integral member. This concept continued to evolve and by the early eighties, over-sized battalions with undersized planning staffs led to consolidation of aviation assets in an aviation brigade. This brigade design provided aviation a streamlined force structure with the critical planning capability necessary to effectively maximize employment of existing systems, as well as modernized systems. The brigade concept was incorporated into the Army of Excellence (AOE) studies in late 1983, and reflects the maturing of AirLand Battle doctrine and its greater reliance on the role of Army aviation.

FORCE STRUCTURE REQUIREMENTS.

Aviation force structure requirements are tailored to support the Army force structure of 28 Divisions and 5 Corps. These requirements include TOE force, training, TDA, and float assets. It is essential to point out that modernization is an iterative process which by its very nature necessitates a high/low technology mix. In determining procurement requirements this fact is recognized. Emphasis is placed on providing the most capable equipment to units that are to first to fight. Later deploying units are resourced with the less modern equipment. Because of cost constraints, we never achieve full modernization. The chart below illustrates this point.

HIGH - LOW MIX
MODERNIZATION STRATEGY



- *MEETS THE THREAT*
- *COST EFFECTIVE*

(SLIDE 1)

While aircraft requirements remain fairly constant, how the army satisfies these requirements changes as procurement allows us to add more capable aircraft to the fleet. For example, in the heavy Attack Helicopter Battalion, the AH-64 replaces the aging AH-1 at a ratio of 18 for 21 and in the Assault Helicopter Companies the UH-60 replaces the less capable UH-1H at 15 for 23. In other words, the mission requirement remains valid but the aircraft type and density required to accomplish a given mission has changed. In order to gain a greater understanding of the impact of our current modernization efforts upon the force structure, it is necessary that we examine the requirements for each of the aircraft categories - Attack, Scout/Observation, Utility, and Cargo.

ATTACK (For inventory see classified annex).

The Attack requirement is best described as a mix of both heavy and light fleet aircraft. These requirements also closely align with the high/low mix concept. This mix corresponds directly with the attack missions which Army aviation is structured to accomplish. The heavy fleet requirement is driven by the Heavy Division, Corps, and theater structures which are the primary forces for dealing with enemy armor in a mid to high intensity conflict. The light fleet is driven by the rapid deployment force (RDF) and Infantry Division (Light) units which are required for quick deployment throughout the world to meet low to mid intensity threats. The AH-64 will be issued to the RDF units as an interim aircraft until replaced by the LHX-SCAT. Additionally, the light fleet is used to fulfill the unique mission requirements of all cavalry and reconnaissance units.

In the near term, the AH-1S remains the backbone of the light fleet, but it is retained in the heavy fleet units until displaced by AH-64 fielding. It is envisioned that the LHX-SCAT will replace the AH-1S in the light fleet.

The AH-64 is the cornerstone of the heavy fleet with its day/night enhanced all weather capability, and increased availability. The fielding of these units is being intensively managed through the use of one station unit fielding. Complete combat ready AH-64 organizations are replacing AH-1S battalions. Because of the lengthy personnel training requirements associated with the AH-64, changes to the fielding schedule must be avoided.

AH-64 Unit Costs. FY 1988 is the last year of procurement for the AH-64. The unit fly-away cost for FY 87 and 88 is $9.069 and $9.015 million, respectively.

AH-64 Plant Status-Mesa. At this time, the Army has no plans for the Mesa plant after the current production is finished, however, there are foreign military sales being discussed that could keep the plant in production beyond the Army's buy of 593 AH-64s. If a follow-on procurement beyond the current programmed quantity costs of taking possession and storage of government furnished equipment. There would be increased overhead and burden rates in FY 89 and beyond for any foreign military sales (FMS).

SCOUT/OBSERVATION (For inventory see classified annex).

This includes those aircraft currently employed in the Scout and Observation role. These aircraft represent the eyes and ears of the aviation force and play a critical role in both the Attack helicopter battalions and Cavalry/Reconnaissance units. In addition, the Scout helicopter is the primary vehicle for the Field Artillery Aerial Observer (FAAO) in both the Division and Corps. The observation requirement incorporates the command, control, and communications role at division, Corps, and theater with the general support mission. Currently, the OH-58/OH-6 family fills both roles with the OH-58D specifically addressing the FAAO requirements. The OH-58D (AHIP) program was terminated at 135 due to affordability. The present OH-58D procurement figure of 135 is the result of continuing the low rate production established by an OSD decision in October 1985. The current OH-58D fielding program for 135 aircraft resources 11 Divisional Command Aviation Companies (66) and 3 Corps Target Acquisition/Reconnaissance

Companies (45). The remainder are divided between the training base (18) and the maintenance accounts (6).

FY 87 AHIP Budget Request. In light of the Congressional language restricting the use of FY 87 funds for AHIP, testing is being designed to specifically answer Congressional concerns on how best to conduct the Scout helicopter mission until the LHX SCAT is fielded. Until that test is completed in accordance with Congressional guidance, the Army seeks release of FY 87 AHIP funds to avoid a production line break.

UTILITY (For inventory see classified annex).

The utility fleet is also divided into a heavy and light mix based both on mission and aircraft capability. The heavy fleet represents the larger of the two just as it does in the attack fleet. The heavy fleet is tailored to address the logistical resupply, assault/air movement (troops, supplies, and equipment), and aero-medevac requirements. The light fleet addresses command, control, and communications requirements in conjunction with general support missions throughout the force. The observation fleet complements the light utility fleet. The training base/TDA is also addressed under the light fleet.

In the near term, the UH-60 constitutes the aircraft for the heavy utility fleet while the UH-1H is the primary platform for the light fleet. The utility fleet by FY-93 will consist of an inventory mixture of UH-60s and UH-1H/Vs. The UH-1H/V will remain the backbone of the utility fleet filling both the light requirement and that portion of the heavy requirement which is not modernized. The Army will require all of the current utility inventory to support the FY 93 force structure. Some Army Reserve units and the maintenance accounts will be resourced at a reduced level. The Army intends to implement a service life extension program for the UH-1H which will enable this aircraft to perform through the year 2010. Recent requirements to provide UH-1 aircraft for foreign military sales and in drug interdiction have had a impact on Reserve Component unit readiness levels.

UH-60 Procurement. The Army has contracted for 855 Blackhawk helicopters through FY 1987 and has received 793 Blackhawks as of December 31, 1986. The current production aircraft are coming off the assembly line with a wire strike protection system, night vision compatible cockpit, hover infrared suppression system and other improvements. FY 88 is the first year of a proposed FY 88-91 multiyear contract. The UH-60 multiyear contracts have been very successful for the Army in the past and the savings from the airframe multi-year procurement I and II equate to 31 UH-60's.

CARGO (For inventory see classified annex).

The cargo requirement is composed of a mix of medium (CH-47) and Heavy (CH-54) helicopters. Unlike the attack and utility fleets, the heavy and medium designation is a historical name rather than a representation of aircraft capabilities. The total FY 93 programmed cargo requirement is 545 aircraft. The current CH-47D modernization program is designed to modify 436 of 472 CH-47A/B/C airframes. Of the 472, 22 are in desert storage. Efforts to provide MH-47E's for the Special Operations Aviation (SOA) requirement diverts airframes previously earmarked for CH-47D modification. These decrements to the conventional CH-47 fleet will impact on fielding levels in previously fully resourced conventional units.

Due to the advanced age of the CH-54 fleet, the Army recognizes the need to provide either product improvement funding or airframe replacement in the future.

AIRCRAFT REQUIREMENTS

The chart on the next page summarizes the requirements for all programmed Active Army, National Guard and U.S. Army Reserve units. The difference between requirements and inventory is a result of budgetary constraints and the balancing of the force. Lower priority units are not fully resourced.

REQUIREMENTS

°ATTACK	ACTIVE	ARNG	USAR	TNG/TDA/FLT	REQUIREMENT
-AH-64					
93 FORCE	504	270	72	185	1031
-AH-1S					
93 FORCE	443	258	21	208	930

TOTAL FY 93 PROGRAMMED RQMT: 1961

°SCOUT/OBSV	ACTIVE	ARNG	USAR	TNG/TDA/FLT	REQUIREMENT
-SCOUT					
93 FORCE	945	576	80	338	1939
-OBSV					
93 FORCE	203	105	25	197	530

TOTAL FY 93 PROGRAMMED RQMT: 2469

°UTILITY	ACTIVE	ARNG	USAR	TNG/TDA/FLT	REQUIREMENT
-UH-60					
93 FORCE	1156	826	378	456	2816
-UH-1H/V					
93 FORCE	302	136	28	830	1296

TOTAL FY 93 PROGRAMMED RQMT: 4112

°CARGO	ACTIVE	ARNG	USAR	TNG/TDA/FLT	REQUIREMENT
-CH-47					
93 FORCE	280	48	48	100	476
-CH-54					
93 FORCE	0	58	0	11	69

TOTAL FY 93 PROGRAMMED RQMT: 545

NOTE: Requirement above does not include unresourced force structure which the Army cannot afford.

V-22 (OSPREY).

The V-22, previously referred to as the JVX, will perform combat support, combat service support, and combat medical evacuation . This aircraft will be used to augment the existing UH-60 fleet and fulfill the following battlefield requirements:

- Move and treat anticipated mass battlefield casualties.
- Assist in overcoming the shortfall in tactical and logistical airlift assets.
- Provide survivable combat service support assets to deep battle and cross-flot operations.
- Assist in overcoming the shortage of intratheater line-haul equipment.

The Army acquisition strategy includes procurement of the baseline version of the V-22, which is also the Marine Corps version. All Army acquisition is through the Navy. The Navy's firm fixed price (FFP), full scale development contract was awarded May 2, 1986, and had a $2.5 billion ceiling. The airframe was noncompetitive; the government furnished equipment (GFE) engine development was leader/follower. All Army funds are Aviation Procurement, Army (APA) only.

LHX

The LHX is intended to be fielded to units with combat, combat support, and combat service support missions. These units operate throughout the close, rear, and deep areas of the battlefield and are organic to Division, Corps and Echelons Above Corps units.

The Scout/Attack (SCAT) version is intended to replace AH-1S and OH-58A/C aircraft in both heavy and light forces. Current plans assign the SCAT to the attack companies of divisional aviation brigades and armored cavalry regiments to perform antiarmor, antiair, anti-materiel and anti-personnel missions; and to divisional and Corps cavalry squadrons, reconnaissance squadrons, and the air cavalry troops of the armored cavalry regiments to perform security and reconnaissance missions. The utility version is intended to replace UH-1H and OH-58A/C observation aircraft. Assignment will be to divisional command aviation companies and Corps command aviation battalions to perform command and control, resupply, medical evacation and other light utility missions. The Cost and Operational Effectiveness Analysis (COEA), and force development tests will assist in the refinement of organization and distribution options. It is envisioned that the improved combat capability and operational availability of LHX will allow the Army to achieve greater effectiveness on the battlefield with reduced numbers of aircraft, greater pilot to seat ratios and fewer maintenance personnel. An example of the breadth of unit level reductions being analyzed is shown in the figure on the next page:

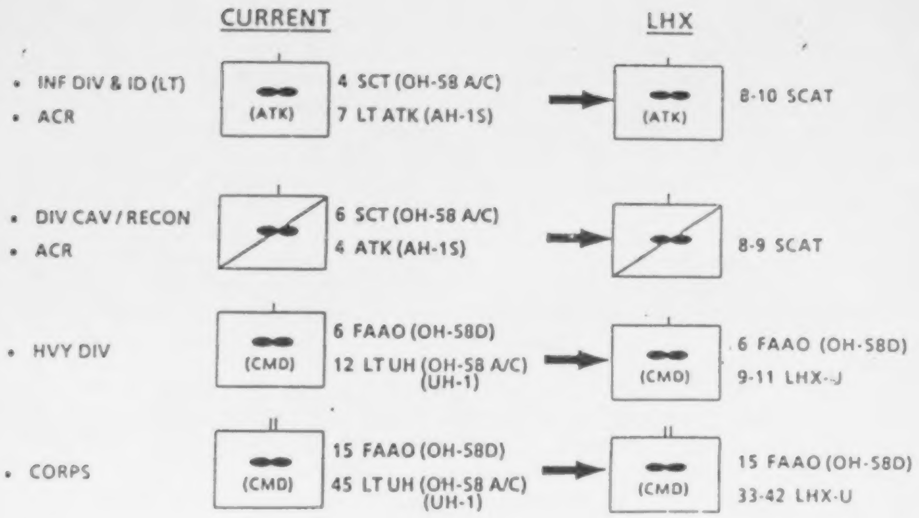

CURRENT
LHX
• INF DIV & ID (LT)
• ACR
(ATK)
4 SCT (OH-58 A/C)
7 LT ATK (AH-1S)
(ATK)
8-10 SCAT
• DIV CAV / RECON
• ACR
6 SCT (OH-58 A/C)
4 ATK (AH-1S)
8-9 SCAT
• HVY DIV
(CMD)
6 FAAO (OH-58D)
12 LT UH (OH-58 A/C)
(UH-1)
(CMD)
6 FAAO (OH-58D)
9-11 LHX-U
• CORPS
(CMD)
15 FAAO (OH-58D)
45 LT UH (OH-58 A/C)
(UH-1)
(CMD)
15 FAAO (OH-58D)
33-42 LHX-U

FIGURE 1 (U) ORGANIZATIONAL CONCEPT FOR LHX

(SLIDE 2)

The impact of the reduced fleet structure will be significant in terms of both improved battlefield reconstitution capabilities and reduced cost of ownership, while increasing both combat capability and sustained operations. The LHX air vehicle will incorporate concepts demonstrated by technology base programs, including the Advanced Digital/Optical Flight Control System (ADOCS), advanced lightweight composite airframe, a bearingless composite rotor system, and an advanced low-drag composite fuselage configuration. These ongoing programs are focused and synchronized to demonstrate the ability of existing applied technology to be utilized in the LHX. The Advanced Rotorcraft Technology Integration (ARTI) program defined the highly integrated cockpit and electronic system architecture. Additional ARTI tasks include single-pilot simulation. The follow-on ARTI risk reduction contracts include investigations of flight performance, aerodynamic interference, aeroelastic and aeromechanical stability, and wind tunnel testing of scale model aircraft.

The primary subsystems in the Mission Equipment Package (MEP) that incorporate advanced technology are: The Very High Speed Integrated Circuit (VHSIC) computer, Electro-Optical Target Acquisition Designation System (EOTADS), wide-field-of-view Helmet Mounted Display (HMD), and the Night Vision Pilotage System (NVPS). Within these subsystems, the principal areas of risk have been identified as the systems level application of VHSIC devices, availability of the full performance second generation Focal Plane Array (FPA) Forward Looking Infrared (FLIR) detector, and the system level optimization of component technologies to achieve a wide-field-of-view HMD system suitable for night and day Nap-of-the-Earth (NOE) operations. Integration of these components into an aided target recognition system will increase the combat capability far beyond today's capability. Each of these areas has been addressed in the ARTI program and breadboard/brassboard hardware demonstration will be continued prior to the start of FSD.

LHX development. The Army's current development program was defined during numerous, detailed reviews conducted between July and November 1986. This program provides a prudent, logical progression from the work accomplished in technology base efforts and the ARTI program into full scale development to meet a critical fielding date in 1995. Full scale development is planned to begin in 1988 with initial efforts directed toward final design and mission equipment package brassboard prototyping. Following critical design review, planned for 1989, efforts will be shifted to build fully equipped prototypes of a one pilot SCAT, two crew member SCAT and utility air vehicles with first flight targeted for 1991. Following extensive developmental and operational testing, a low rate production decision is expected in 1993. Operational testing and production refinement will lead to an initial operational capability and full production decision in late 1995. Full rate production goals are approximately 2000 SCAT and 2500 utility aircraft.

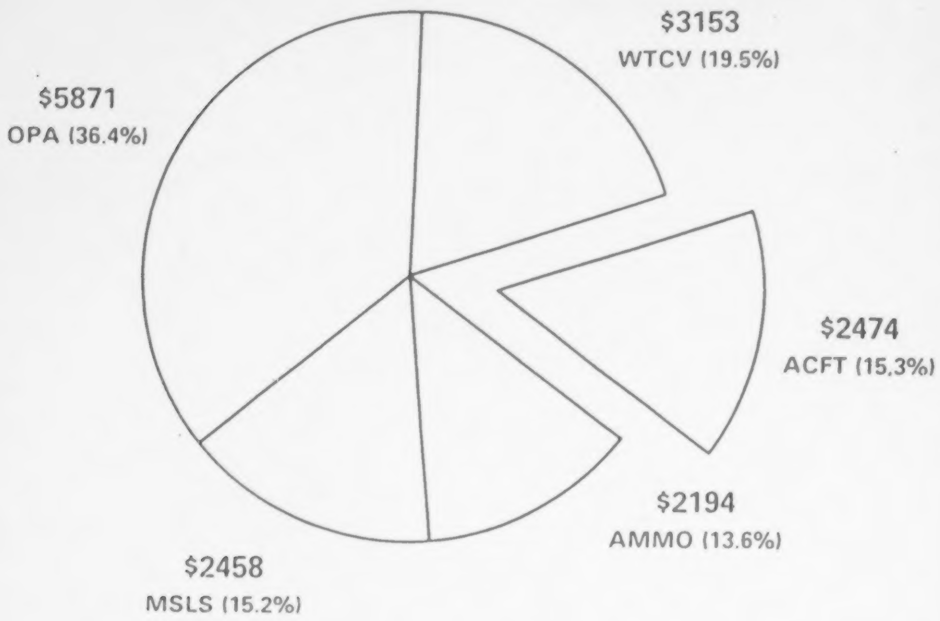
Major adjustments from last years' acquisition strategy are the reintroduction of full competition throughout design, prototype, test, and production. The requirement for a 1995 operational capability, critical replacement of the aging helicopter fleet, and T800 engine program development schedule remain unchanged. Detailed cost estimates are being finalized in preparation for the April Milestone Decision Review.

FY 87 LHX Budget Request. The fiscal year 1987 request for $44.42 million is required to fund the ARTI efforts initiated in 1985. These basic developments support a wide variety of airframe and mission equipment efforts which have set the foundation for the Light Helicopter Family (LHX) program to enter full scale development in 1988. These same ARTI developments are supportive of other Army aviation programs and would provide substantial benefits even if there were no LHX program. The 1987 efforts provide for additional aircraft/ mission simulation, continuation of surrogate aircraft cockpit/ systems demonstrations, continued brassboard demonstration of mission equipment components, and wind tunnel testing of aircraft and component designs. The 1987 ARTI contract efforts were initiated in October 1986 using residual fiscal year 1986 funds. As these funds were expended, stop work orders were issued to industry in November and December 1986. The Army requested partial release from the restrictions on obligation of fiscal year 1987 funds from Congress in December 1986 to allow the required work to be accomplished. The Army and OSD were prepared to submit cost certifications to the Congress in July 1986. Major changes in prototyping strategy, recommended by the Defense Science Board and approved by the Army caused a revalidation of these costs with a delay in submission. These cost figures will be provided by DOD following the Milestone Decision Review in April 1987. The House of Representatives has, contingent on Senate agreement, approved release of up to $24.6 million in LHX ARTI funds. The Army continues to strongly support partial release of the fiscal year 1987 funds pending receipt of the defense cost data.

AVIATION PROCUREMENT, ARMY (APA)

Army's Budget Procurement Request. The Army aviation request for FY 1988 is $2473.9 million, which is 15.3% of the Army's budget procurement request as shown below:

FY88 PROC BY APPROP ($MILLIONS)



(SLIDE 3)

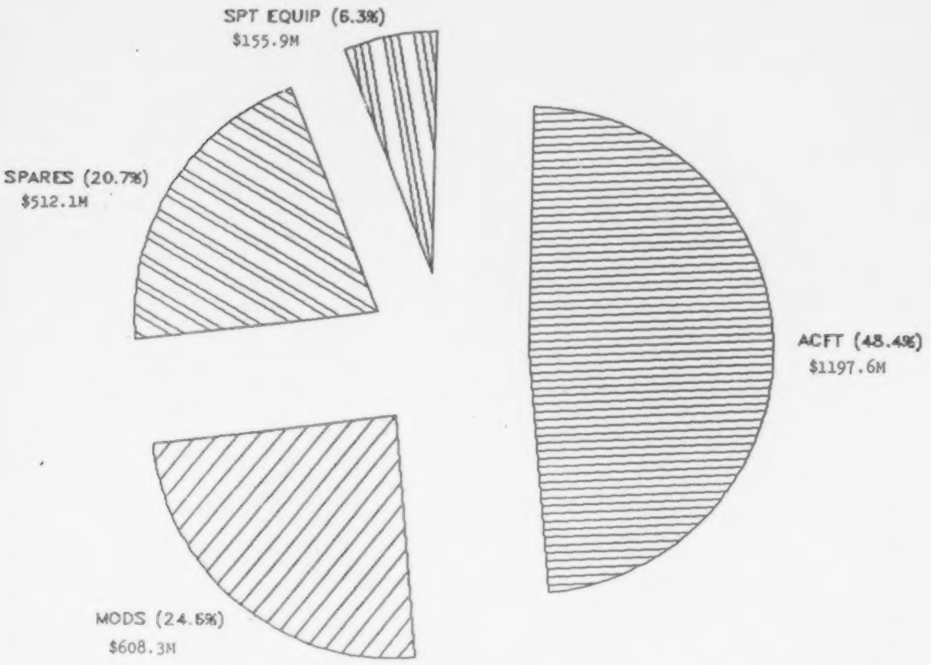
The FY 88 budget request is broken out below by budget activity.

AIRCRAFT PROCURMENT, ARMY
FY 1988
($ IN MILLIONS)

Budget Activity	FY 1988
1. Aircraft	$1197.6
2. Modification of Aircraft	608.3
3. Spares and Repair Parts	512.1
4. Support Equipment and Facilities	155.9
Appropriation Total	$2473.9

Slide 4 reflects the overall funding breakout:

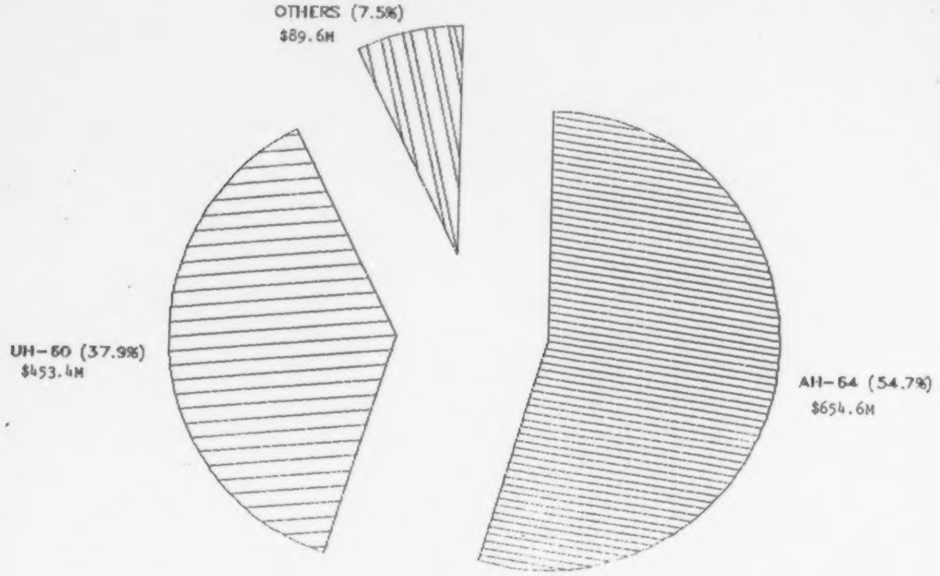
FY 1988 ARMY AIRCRAFT FUNDING OVERVIEW



(SLIDE 4)

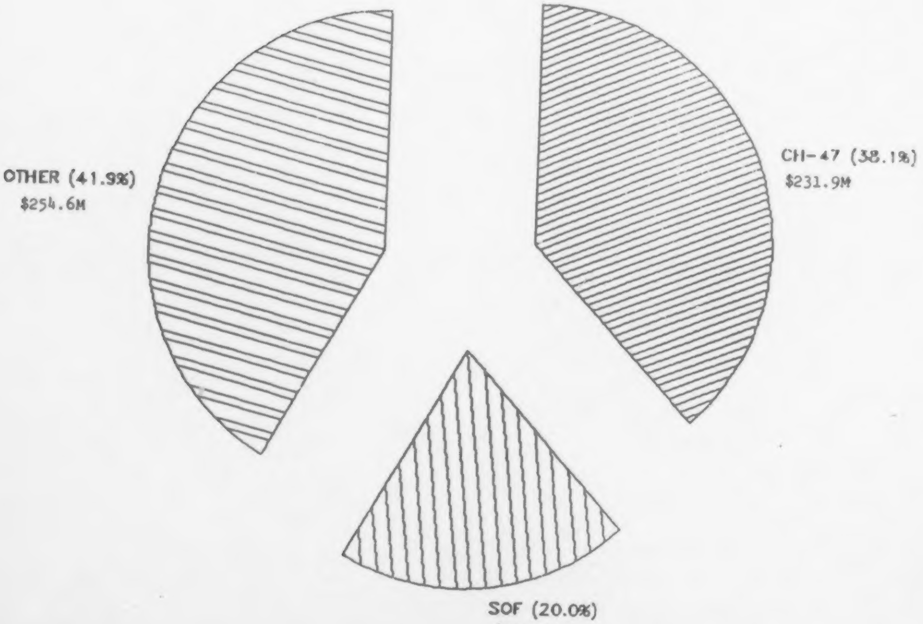
As can be seen, procurement and modification of aircraft compose 73% of the FY 88 aircraft budget with spares and other support making up the rest. The 73% of the aircraft budget is composed of basically four programs: Procurement of the UH-60 and AH-64 aircraft and the modification of the CH-47 and SOF aircraft as shown on the following charts:

FY 1988 AIRCRAFT PRODUCTION FUNDING



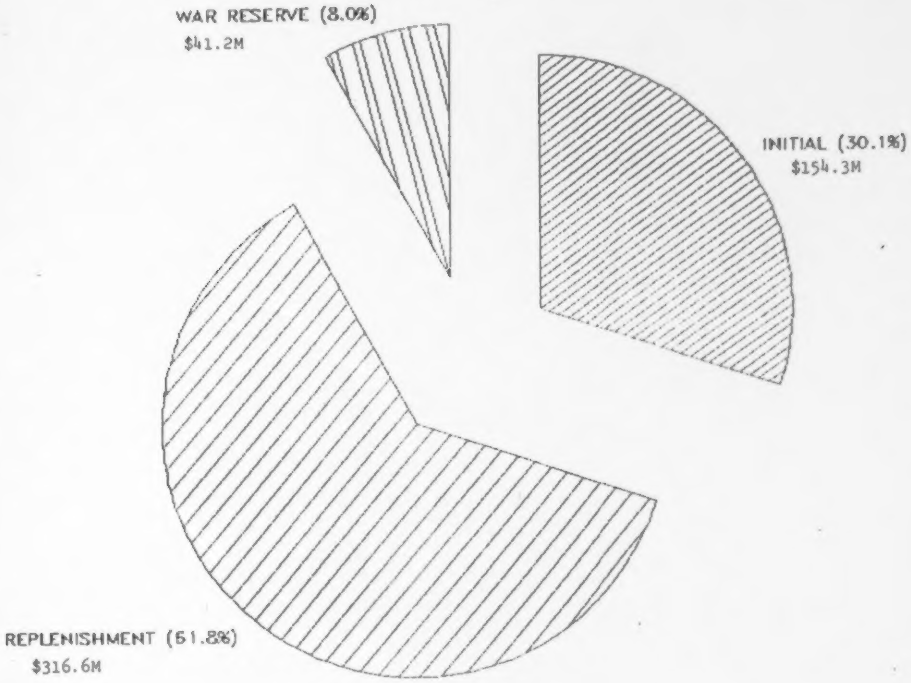
(SLIDE 5)

FY 1988 AIRCRAFT MODIFICATION OVERVIEW



(SLIDE 6)

FY 1988 AIRCRAFT SPARES OVERVIEW



(SLIDE 7)

Replenishment Spares ($316.6M). Replenishment spares are required to support fielded aircraft. The FY 88 funding requirements are driven primarily by the Army's Flying Hour Program.

Initial Spares ($154.3M). Initial spares are required to support the initial fielding of aircraft. The FY 88 AH-64 and UH-60 production programs account for more than 75% of the FY 88 initial spares program.

War Reserve Spares ($41.2M). War Reserves are selected spares items which are crucial to support operations in a wartime environment.

Major Budget Changes. The major changes from the FY 88 estimate in the 87 budget are driven by reductions in Total Obligation Authority (TOA). They are shown below:

3 RC-12D (GR/CS)	$ -27M
11 EH-60 (QUICKFIX)	-88M
24 UH-60 (BLACK HAWK)	-91M
32 OH-58D (AHIP)	-198M
SPARES	-274M

and an increase in:

2 GOLDEN KNIGHT A/C	+13.6M
SOF	+54M

Last Ten Years Aviation Budget and the FY 88-92 Plan. Since FY 77, the Army has brought into production and will have procured by the end of FY 87, 859 UH-60's, 526 AH-64's and 66 EH-60's. There has been extensive modernization of the CH-47 and AH-1 fleets.

In addition, the Army has made substantial progress in increasing aircraft readiness and the Flying Hour Program through substantial investment in the aircraft spares program.

Generally, the FY 88-92 plan is a transition period during which the major procurements and modernization efforts begun in the late 70's and early 80's are completed and phased out prior to beginning new initiatives. The only new major procurement initiated in this period is the RC-12K reconnaissance aircraft and the V-22 OSPREY.

Production plans for Army rotary wing aircraft between 1990 and the start of LHX Production are show below.

	FY 90	FY 91	FY 92	FY 93	FY 94
UH-60	72	47	-	-	-
LHX	-	-	-	-	48
V-22	-	-	8	14	24
Total	72	47	8	14	72

The phase out of production for the AH-64, AHIP and UH-60 significantly lowers the total production rates of McDonnell Douglas Helicopter Company, Bell Helicopter Textron and Sikorsky Aircraft Company. The AH-64 production line completes the last aircraft in the first quarter of FY 90. The relative magnitude of the commercial business is less than 10 percent of McDonnell Douglas Helicopter Company total business and would not sustain the Mesa plant.

AHIP production ends in second quarter FY 89. Bell Helicopter Textron has numerous commercial production programs, foreign military sales programs, and aircraft modification programs, like the AHIP. The Bell-Amarillo facility is dedicated to aircraft modifications and programs which will phase out in 1989. There may be insufficient requirements for Bell to justify this facility, and could cause layoffs or plant closings. Bell's V-22 production begins after 1991.

Blackhawk production is complete in the fourth quarter FY 91. Sikorsky has potential commercial sales of H-60 aircraft of 12 to Saudia Arabia and 38 kit aircraft to the Royal Australian Air Force which will be final assembled in Australia. Navy procurement of the MH-53E and the CH-53E continues until the production of the LHX. Their production is equal to four times the work content of a UH-60A Black Hawk and will maintain a reduced production base at Sikorsky.

SUMMARY.

Most of the Army's helicopters are Vietnam-era aircraft, albeit with many upgrades; the Army accepted delivery of its first UH-1 (the venerable "HUEY") the same year that President Eisenhower signed the papers for Alaskan Statehood (1958). OH-6's (the "LOACH") entered production the year the first US combat troops went to Vietnam (1965); the OH-58 prototype made its maiden flight one year later. The AH-1 "COBRA" entered production in 1967 between US deployment to the Dominican Republic and the Glassboro Summit Conference. Despite many improvements and yeoman attention, these aircraft are barely competitive in today's combat environment. Seventy-six percent of Army aircraft average over 17.5 years old. The Army has investigated their potential for total rebuild. The utility is not there; technology has completely passed them by. These aircraft are marginal for now--they are not a solution for the future. Their costly modernization now would only buy us a few years. This is why the LHX is the aircraft for the future.

LHX incorporates proven technologies to provide a combat capability for the 1990s and beyond. Flying demonstration aircraft, of seven separate types have adequately demonstrated the required flight control architecture, composite airframe and fly-by-light capability. Other work has shown that single pilot capability is achievable and that significant progress has been made in reliability, maintainability, and survivability. For example, heads-up dislays, VHSIC processors, and in the field battle damage repairs, plus many other projects in ARTI and the technology base are complete. The LHX engine is well along in development and has been tested. It will be successful. Every indication is that LHX system requirements are mature in the technology base, having been demonstrated in the laboratory and in functioning aircraft. It is time to begin prototyping in full scale development. This year's budget requests funds to start this level of work.

While all Army systems, including aircraft, are built with preplanned product improvements in mind, there is a generation of technology that is associated with a system that limits its ultimate life-span. When the LHX is fielded, it will not only replace our Vietnam-era fleet, but also provide a technological leap forward from our current aircraft--the UH-60 Black Hawk and the AH-64 Apache. These two outstanding aircraft, now in production and being deployed to the force, modernize our capability through the 1990's and into the early 21st century. The UH-60 and AH-64 are based on 1970's technology; the LHX will capture 1990's technology to push its life-span well into the 21st Century.

It is clearly in the best interest of the Army and the nation to continue the LHX program as currently conceived. The concept evaluation phase has demonstrated technologies that will warrant full scale development of LHX.

The Army Aviation program is prudent, well reasoned, and essential. Our older helicopter fleet must be replaced. LHX is the future of combat aviation. The Army is ready to begin LHX development.

SUBJECT: **Army Helicopter Inventory** 12 Mar 87

The figures below reflect anticipated Army helicopter inventories (at end of each FY) through FY 1997. Projections were determined in the following manner: Start with current inventory; add known/anticipated procurement; subtract planned phase-out; substract attrition (based on historical averages).

PROJECTED INVENTORY

	FY87	FY88	FY89	FY90	FY91	FY92	FY93	FY94	FY95	FY96	FY97	REMARKS
ATTACK HELICOPTERS												
AH-1S	1086	1081	1076	1071	1066	1061	1056	1051	1046	1041	1036	
AH-64	280	424	568	591	589	587	585	583	581	579	577	
UH-1M	170	121	85	55	8	-	-	-	-	-	-	NOTE 1
OBSERVATION AND SCOUT HELICOPTERS												
OH-58A/C	1843	1834	1825	1816	1807	1798	1789	1780	1771	1762	1753	NOTE 2
OH-58D	72	111	134	133	132	131	130	129	128	127	126	
OH-6/MH-6	364	362	360	358	356	354	352	350	348	346	344	
TH-55	237	236	-	-	-	-	-	-	-	-	-	NOTE 3
UTILITY HELICOPTERS												
UH-1H/V	3295	3280	3265	3250	3235	3220	3205	3190	3175	3160	3145	
UH-60	815	875	940	1007	1067	1062	1058	1054	1050	1046	1042	
CARGO HELICOPTERS												
CH-47	450	449	448	447	446	445	444	443	442	441	440	NOTE 4
CH-54	72	72	72	71	71	71	71	70	70	70	70	
ELECTRONIC HELICOPTERS												
EH-1		Deleted				Deleted		Deleted		Deleted		
EH-60											-	
FUTURE ROTORCRAFT												
LHX	-	-	-	-	-	-	-	-	18	42	78	
V-22	-	-	-	-	-	-	-	-	9	14	24	
ACA	-	-	-	-	-	-	-	-	-	-	-	NOTE 5

NOTES:

1. UH-1M being phased out; replaced by AH-1S in ARNG.
2. Includes airframes in mod line to become OH-58D's.
3. TH-55 will be phased out as primary trainer.
4. Includes airframes in mod line for D-Model conversion. Does not include 22 airframes in storage.
5. Anticipated to enter inventory after 2000.

HEARING PROCEDURE

Chairman STENNIS. General Wagner, we appreciate your presentation. I wish there was much more time for you to present the matter further, but we want some time now for attendance of the membership.

I have some questions, and for the time being I am going to ask that they be inserted in the record for answering later by you. We will proceed now, gentlemen, to questions by the membership here. We have matters at 12 o'clock that pertain to all of us. We have a debate this afternoon, in which all the argument will be presented on a matter with 10 hours equally divided is what the rule says.

I was thinking about—this is very important—thinking about having another appearance of some of these gentlemen here, and we might invite you to come back. But let us make time count as much as we can now. I know you came here to listen to the testimony. It is now 10:35 a.m. Let us try 7 minutes to each person and see how that works and try to get around to all.

Senator Stevens, I call on you first, the ranking minority member. You can proceed in your own way.

Senator STEVENS. Thank you very much, Mr. Chairman.

CORRESPONDENCE

Congressman Bill Dickenson has written to you and to me concerning his questions about the Army procurement program in helicopters and armored vehicles, and I would ask that his letter be printed in the record, Mr. Chairman. I think he has got some very interesting points that we will have to consider, so if you do not mind I would ask unanimous consent.

Chairman STENNIS. Without objection, it will be inserted in the record at this point.

[The information follows:]

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U.S. House of Representatives
COMMITTEE ON ARMED SERVICES
Washington, DC 20515
ONE HUNDREDTH CONGRESS
LES ASPIN, WISCONSIN, CHAIRMAN

March 16, 1987

Honorable Ted Stevens
Committee on Appropriations
Subcommittee on Defense
United States Senate
Washington, D.C. 20510

Dear Ted:

You may be aware of initiatives that I am taking to add funds to the Army procurement account to increase the numbers of helicopters and armored vehicles that have been requested in the FY 88 DOD budget. I had asked my staff to inquire about the possibility of my testifying before your Defense Subcommittee during its Army aviation hearing on March 17. I understand that you have limited testimony during that hearing to DOD witness only. Therefore, I would ask your help in entering my views into the hearing record and, if appropriate, summarizing them for your Members during the hearing.

Please consider the following:

1. There is growing bipartisan support in the House for the idea that needed conventional capabilities, essential to the readiness of our ground forces, are being sacrificed in the DOD budget in favor of other more glamorous systems.

2. While the total Army share of the DOD budget has remained fairly constant at slightly over 26 percent, the Army share of the investment portion of the budget is projected to decrease from 21 to 16 percent over the FY 81 to FY 89 time period.

3. Reductions in Army investment have been concentrated in the procurement of helicopters and armored vehicles. The AH-64 Apache is to be terminated after the FY 88 buy, the AHIP program is to be cancelled after the FY 87 buy, and the procurement profile of the UH-60 Blackhawk is reduced to a level that is less efficient and may threaten the multiyear procurement savings. In tracked vehicles, the DOD budget reduces M-1 tank production from a historical rate of 840 to 600 per year and reduces Bradley Fighting Vehicles from 720 to 616 per year.

4. I recognize that deficit considerations will create another defense budget crisis this year, and that discretionary funds will not exist to restore these programs to their most efficient levels. Nonetheless, I intend to offer an amendment in the House Armed Services Committee that will restore many, if not all, of the reductions in these important conventional programs. I will appreciate the support of you and your colleagues as we proceed with our consideration of the FY 88 defense budget.

I appreciate your help, Ted, and look forward to working with you this year.

Sincerely,

Bill

William L. Dickinson
Ranking Minority Member

SCOUT HELICOPTERS

Chairman STENNIS. Now we have had quiet here this morning, and that is very helpful, very helpful, and I ask for a continuation of it by all of our visitors, those that are testifying, and those of us that are here to listen. Thank you.

You may proceed.

Senator STEVENS. General, our conference report last year directed the Army to prepare a detailed report detailing the Scout helicopter plan if the Army helicopter improvement program was canceled. Now you do not request any funds for that AHIP program for 1988. I am told that even if the 1987 funds are released only two-thirds of the OH-58's planned for upgrade will be completed, and I would like to know what is the status of that study that we requested last year.

Are we going to get that?

General WAGNER. Sir, that is a test. There are two parts to it. First, we are looking at analysis of it. The real proof of the pudding is what can we do by test. We are starting a test right now that is in two phases. Phase I, to look at what we will use to scout for our attack helicopters, since we will not have the OH-58D to do that because that program has been zeroed.

Phase II is to look at the mix between scout aircraft and attack aircraft to make sure that we have the most effective mix of equipment on the battlefield. We will be providing that data as the tests are completed.

Senator STEVENS. Well, General, the impression I get from your presentation—and you gentlemen have done a good job in making your presentation—is that we are going to have a gap of 7 years in our procurement program really for helicopters and we are really not doing much about retrofitting to meet the problem of that 80 percent you say of our helicopters that cannot meet the threat.

Now was this not a helicopter improvement program basically designed to give us day/night, all climate, laser target and other defense capabilities to meet that gap of the 7 years?

General WAGNER. Yes, sir; it was.

Senator STEVENS. Well, then why aren't we releasing the money?

AIRCRAFT PROCUREMENT

General WAGNER. We are not releasing the money to buy up to the 135, because it is held by Congress until we complete the test. We have requested that the dollars be released so that we can continue the long-lead procurement and not have a break in that production.

As far as continuing the procurement, it just would not fit into the amount of dollars we had available in the Army to buy equipment. We had to stop that program like we stopped and slowed down others.

Senator STEVENS. Well, it appears to me that you filled in that gap rather neatly, and I understand the way you did it. The budget has been cut. Are you really saying the Army would prefer to have those gaps filled in between now and 1995 the way your second layover chart did in each one of those procurements?

General WAGNER. Certainly, sir. If we had the dollars available, we would fill in the gaps in aviation, just as we would in other items of equipment.

Senator STEVENS. If we filled them in, we would still be putting out helicopters that will join the 80 percent, not join the new function. Why is it not more cost effective to go back and have the improvement program and make it work and upgrade what we have got and look forward to the LHX in 1995?

LHX IMPROVEMENTS

General WAGNER. That does make sense, sir. It is just that we did not have the dollars to improve them, so we will have to take what we have available—the OH-58C's and we are looking at other aircraft until we get the LHX. We just could not afford to modify them. If we had the dollars, we would modify them to fill that gap.

Senator STEVENS. Maybe I am not getting through. You did not present that to us. You presented to us the gap in the procurement and said now if we had this much money we could fill that procurement to 1995, but it seems to me, as I said, that that additional procurement will still procure you more helicopters that would fit into the 80 percent that could not meet the threat.

What are we doing to meet the threat between now and 1995?

General WAGNER. We did not present that, sir, because in the overall prioritization which General RisCassi's people deal, with the AHIP, which is the Army Helicopter Improvement Program [AHIP], was not as high a priority, if we had dollars available, as buying additional attack helicopters and Black Hawks.

Senator STEVENS. Even if they are not capable of meeting the threat?

AIRCRAFT PRIORITIES

General WAGNER. They are—the current Scout helicopters are just as capable of meeting the threat as the Hueys and some of the other 80 percent of the aircraft we have out there. It is a problem across the board and the attack fleet has our greatest shortage now. If we had additional dollars that would be the first place we would put them.

Senator STEVENS. Let me put it this way. If we gave you the dollars, would you be able to acquire helicopters that would be at least as good as the AHIP program would have made the existing helicopter?

General WAGNER. If we had the dollars for all of our priorities we would buy the AHIP, because it is the best modified aircraft for that mission available today.

Senator STEVENS. And what would you do for the balance of the 80 percent that are not threat-capable?

General WAGNER. We are making some minor modifications, for example on the Cobras, by giving a number of them a C-nite capability that gives them some capability to fight at night—not on a par with our current attack helicopters. And we have other SLEP programs.

Senator STEVENS. Well, I get the impression—this is my last question, Mr. Chairman—I get the impression that your whole proposal is you want the LHX and you understand the problems of waiting until 1995 to move into that procurement, but that you really have not given us a proposal which says if you support LHX then give us this much money to help us meet and make the maximum number of our existing helicopters capable of meeting more of the threat than they can meet now.

I mean, some of this improvement is just an annual or 2-year improvement program, is it not?

LHX MODIFICATIONS

General WAGNER. Yes, sir; we have modification programs in our budget, but they are not the big-dollar items, and I was covering the big-dollar items here. We do have modification programs in our budget. For example, we are also bringing up to a better standard our EW aircraft, the Mohawk, and several of those to make sure we can carry them into the next century.

Senator STEVENS. I would like to see that concept of how we can upgrade the maximum number of existing helicopters and the ones we procure in the next couple or 3 years so we can stay on the LHX and at the same time reduce that 80 percent figure. If you have got information on that, I would like to see it.

Thank you, Mr. Chairman.

General WAGNER. I will.

[The information follows:]

HELICOPTER UPGRADE

The following chart depicts the Army's planned upgrade of selected aircraft over the fiscal years 1988–90 timeframe.

[In millions of dollars]

Item	Fiscal year—		
	1988	1989	1990
OV-1 airplane	17.5	31.6	34.8
RC-12 airplane			21.6
RU-21 airplane	3.2	7.5	7.1
RV-1 airplane		12.5	13.8
AH-1S helicopter		29.3	32.0
AH-64 helicopter	78.8	44.0	48.7
CH-47 helicopter	231.9	265.4	254.6
OH-58 helicopter	37.0	80.4	106.7
UH-1 helicopter	9.4	8.3	9.7
UH-60 helicopter	33.8	33.6	41.4

ARMY AVIATION BUDGET REVIEW

Chairman STENNIS. All right. That brings us to Senator DeConcini.

Senator DECONCINI. Thank you, Mr. Chairman, very much.

I have a number of questions for the generals. I appreciate their thorough briefing here today and I want to thank the chairman for having this very important subcommittee hearing and briefing.

General, the Army aviation budget is, quite frankly, unrealistic in the priority of effective threat to the American security, at least it appears to me. The Army aircraft procurement account shows an average decline of 13 percent per year from 1987 through 1991. These changes reflect the lower-than-anticipated Apache fund request, the canceled Army Helicopter Improvement Program, and the canceled plan to increase and extend the buy of the cheaper UH–60 Black Hawk helicopter beyond 1991.

The Apache was designed to complement and eventually replace the AH–1 initially fielded in the mid-1960's. The AHIP is a major modification to the OH-58A, which was fielded about 1970. The Black Hawk is to replace the UH–1 Huey, which has been in the inventory since 1960. These new production units are replacing 20- to 30-year-old aircraft.

According to the Army, Soviet helicopters have been increasing, as your demonstration this morning points out, far faster than we have, and maybe have surpassed us. Now if the Black Hawk, the Apache and the AHIP production lines are all shut down in the next 2 to 3 years, by 1991 we not only have closed production lines but we have almost no ability to improve the aging aircraft in inventory since 1960 to respond to the growing Soviet threat or to replace a potential loss of new aircraft in a conflict.

What effect does the reduced quantity have on our national defense? Before you answer that I want to point out that I am currently working with the General Accounting Office to answer just that type of question. They will be producing a study on my request.

I would also like to ask you what is the Army going to do about the 5-year plan that takes procurement down to near nothing in 1991, and does this not dangerously compromise preparedness and training to allow the Apache, the Black Hawk and the AHIP lines to go cold 5 years before LHX production can even begin?

General WAGNER. Quite obviously I agree with you, sir, that has an effect on the Nation's capability to fight. We had to look at what are the deficiencies in the Army, looking at the three areas we fight in—the deep battle, the close battle, and the rear battle. We have put significant dollars into these two aircraft in the last 5 years. We have greater deficiencies in command and control and so forth, so in this 5-year period we are concentrating in that area and that is the only area where you see any growth in our procurement accounts.

And as the new LHX helicopter comes on in 1995 we will step it up. It is a calculated risk that we had to take when we had the significant reductions.

LHX SCOUT/ATTACK HELICOPTER PRODUCTION

Senator DECONCINI. General, answer this for me, then. The Army's LHX scout/attack helicopter production is really not expected before 1995 or 1996; isn't that correct?

General WAGNER. That is correct, sir.

Senator DECONCINI. Maybe even 1997. Do you feel comfortable with stopping production of what is the world's best attack helicopter, being unable to replace the peacetime losses? Would it not make more sense to keep Apache production at at least a much lower rate than what we are doing today? Would this not be more cost effective and ensure our national security than to put all our eggs in the LHX basket?

That is what it looks like you are doing. Maybe that is not it.

General WAGNER. Yes, sir; I would like to comment on that last question first. First of all, it is a perception that we have traded off the new aircraft we can produce right now to buy the LHX. That is not true. The dollars that we would need to keep all of those production lines going exceeds probably three times the dollars that we would need to develop the LHX. So that is not an equal trade.

Personally I would like to keep all lines going, but when we look at the dollars available we cannot balance our budget in a balanced fashion to fight the battle by doing it.

ARMY ACQUISITION OBJECTIVE

Senator DECONCINI. If you buy only 593 Apaches, as proposed in fiscal year 1988–89, you will end up with 539 in the Active Force and only 54 in the Guard, which is 20 percent of your requirement for the Guard, and it appears none for the Reserve, as you pointed out. That is barely 55 percent of the requirement. So I realize that 1,206 is an Army acquisition objective and that is not likely to come about today.

Although the Cobras have undergone many improvements in the past years, units that keep the Cobra will lose the night, adverse weather, hot climate and other advantages of the Apache. What effect will this have, gentlemen, on where the Apache will be stationed in the United States and how about the battalions in central Europe?

General RISCASSI. Sir, right now on the Reserve structure side there is one battalion of Apache going into the program for North Carolina, one for South Carolina. Those are Guard battalions. To the best of my knowledge, we do not have any aviation attack assets in the Reserves.

The first units to be equipped with the AH–64 Apache will be trained to a standard at Fort Hood and as a battalion, be forward-deployed to Europe.

Senator DECONCINI. Will they be stationed in Europe?

General RISCASSI. Yes, sir.

Senator DECONCINI. As the primary or first——

General Riscassi. It will be a PCS move. Well, it depends upon how you define "first." Their first station would be Fort Hood. When they attain a degree of standardization and proficiency, then they will be moved to Europe.

General WAGNER. Because of problems, sir, in a possible conflict in the Middle East or Southwest Asia, in the interim, until we get the LHX, we are putting five battalions of the AH-64 into our rapid deployment force. This is a light force, but we are putting them there because that gives them the high, hot capability they need to fight in that area.

Senator DECONCINI. How many go there?

General WAGNER. There will be five battalions worth, sir, about 100 aircraft.

APACHE PRODUCTION

Senator DECONCINI. General Wickham, the Chief of Staff of the Army, mentioned possible extension of the Apache program while testifying a few weeks ago. He has been quoted as saying, and I want to be sure this is accurate: "The very next marginal dollar we get from Congress I would think we would want to put it into the Apache." Last week General Thurman stated that the Apache was the first priority on the Army's buy-back list.

COST OF REINTRODUCING SHUT-DOWN APACHE LINES

What I do not understand—and do not get me wrong here, Generals—is how we get caught in this position of Apache lines going down for 5 years before the LHXs come on. It just seems that the Air Force and Navy continue their lines at some production level. It would be awfully costly to try to pick up those lines. Have you done any studies of what it would cost if you decided that for security reasons you had to start reproducing the Apache, say in 1990, after the lines were shut down? What is the basis, the cost comparison between that and keeping it at a lower production through this gap that you talk about?

General WAGNER. I will have to provide the specific costs for the record, sir. It has been studied. It is not a huge amount compared to spending $800 million to $1 billion a year to keep the line hot, but I just cannot off the tip of my fingers. I do not have that number; I will provide it to you.

Senator DECONCINI. Would you supply that for us, please?

[The information follows:]

APACHE PRODUCTION

The estimated cost to maintain Apache production at the minimum economic rate of 72 per year through fiscal year 1990 would be $1.8 billion for 154 aircraft. The cost to restart a cold production base in fiscal year 1990 would be approximately $800 million to $1 billion for 26 aircraft which would provide a 4 per month production rate at the end of the fiscal year 1990 funded delivery period.

APACHES FOR THE NATIONAL GUARD

Senator DECONCINI. My time is up, and I want to thank the chairman. However, Mr. Chairman, I have one question that I would ask that I be permitted to ask on behalf of Senator Chiles, if I may. He cannot be here today because of the Budget Committee.

Chairman STENNIS. Surely.

Senator DECONCINI. General, I understand that the Army is in the process of making a decision contrary to the intent of Congress, as expressed in the 1987 defense budget, to not give 18 AH–64 attack helicopters to the Florida Army National Guard. Can you comment on that? It is correct and would you respond, please, for Senator Chiles and this Senator as well?

Chairman STENNIS. If you need time to comment on that, we will give you time. Otherwise, answer it.

General RISCASSI. Let me give it a try. I think we were mandated by Congress to provide three battalion sets to the Reserve or Guard structure. North Carolina, South Carolina, and Florida were the three States of choice. The decision was based on buying 144 Apache airframes. Since that number went down to zero, I think it was, 101, we backed away from fielding the third battalion in Florida. The Chief of Staff of the Army is in the process of responding back to the Congress with an answer.

Senator DECONCINI. Well, can I assure Senator Chiles he will get a specific answer to this, whether or not you agree that the intent of Congress, as expressed in the defense budget, has been complied with?

General RISCASSI. Yes, sir.

Senator DECONCINI. Thank you. Thank you very much, Mr. Chairman, for the extra time.

Chairman STENNIS. Thank you very much, and bring that in for the record, too, the answer you give.

General RISCASSI. Yes, sir.

[The information follows:]

APACHES FOR NG

Congress mandated that 18 AH-64's per year in fiscal years 1985–87 be assigned to the ARNG. The fiscal year 1986 mandate was conditioned on the procurement of 144 aircraft. However, reduced funding and a higher than anticipated unit cost limited fiscal year 1986 procurement to only 116 AH-64's. It was, therefore, the Army's interpretation that congressional intent required only two AH-64 units be assigned to the ARNG. However, we now believe that the intent of Congress was to allocate three battalions contingent on ARNG readiness capability and ability to assimilate the complex AH-64 equipment and mission.

Chairman STENNIS. Senator Rudman, that brings us to you, sir. We agreed on 7 minutes.

Senator RUDMAN. Thank you, Mr. Chairman. I will hold to the 7 minutes.

TRAINING DOCTRINE

General RisCassi, did I understand you to say in your statement that the doctrine that was being evolved was going to be derived from the force structure as planned and as exists, or did I misunderstand?

General RISCASSI. If I said that I misspoke to you, sir. Basically the doctrine, as you and I have talked in the past, has evolved to fill a vacuum in our doctrinal development caused by the focus on Vietnam and technological changes in close combat capabilities. What we did is roll back and look at some historical and empirical data for what was good, what won battles in the past, and framed those into the four tenets that you saw on the chart. We developed a doctrine to fit the 1980's. We were trying to make that expression usable to the field commanders. We then changed our force structure, which we call the Army of excellence, to reflect that doctrine.

Senator RUDMAN. Well, obviously I understand that. I just wanted to make the record clear, since there is a transcript here. You certainly were not suggesting that you derive doctrine from existing force structure. It is quite the opposite in an ideal world, I assume.

General RISCASSI. Yes, sir.

LHX

Senator RUDMAN. I have a specific question about LHX and I ask it knowing that you have had to look into the future and you have had to make a decision. Everything is a gamble because you really do not know what you are going to have in 1995. You hope you know what you are going to have, but based on procurement not just of the Army but of the Air Force and of the Navy, as you look at programs as they originally were developed and designed and the doctrine that was evolving from those acquisitions and what they got, they are quite often different.

Here is my question. It is my understanding that the air-to-air capability of LHX is problemmatical at this point. I understand from what is going on down at Rucker that there have been some thoughts of doing things to make it more air-to-air capable, but that is in the early stages. And yet your statements contain very accurate evaluation of Soviet forces in terms of their air-to-air capabilities.

You are talking about LHX as a system which to a large extent, much of it antiarmor, which we understand for what the land battle doctrine is. Here is my question.

How do you get into a situation with this LHX that does not have a really capable, robust—to use your word—air-to-air capability? If you deploy it in an antiarmor capability, if it is going to be meeting forces that have air-to-air capability I submit to you you cannot do both missions at the same time. It will never to carry out its primary mission.

What are you doing about that? To me that is a very basic question.

General ANDRESON. Sir, I am Brigadier General Andreson, program manager for LHX.

We feel that the program as it is currently structured—that is, with the requirement document, the ROC as it is stated and the planned development and design of the LHX—we will in fact have a very capable air-to-air platform as well as an air-to-ground platform.

Senator RUDMAN. Simultaneously?

General ANDRESON. Absolutely, sir. There are three facets to air-to-air effectiveness. One is maneuverability and agility that is characterized by an airframe that can turn at high G maneuvers, has ample power and ample power margin is very essential to maneuvering, particularly in rotary wing air-to-air combat. The LHX design criteria is significantly above that of the Apache in that regard and we feel at least equal to the threats that we see the Soviets putting on the battlefield in the 1990's and beyond.

A second aspect is target acquisition. In that regard LHX will have a vastly improved sensor package as a part of its overall mission equipment package that will enable it to rapidly and accurately acquire rotary wing threat aircraft.

And, of course, the third leg of that triad is the weapons system itself. LHX is planned to be armed with the air-to-air Stinger missile for longer-range air-to-air engagements, and with a turreted gun of either 20, 25, or 30 millimeter that can be fired off the cueing of whichever direction the single pilot that is operating that scout/attack aircraft is looking. It will be slave to the helmet-mounted display device and allow him to engage rapidly and accurately off axis up to as much as 120 degrees laterally, 15 degrees up, and almost 45 degrees down in close-in engagement to provide a killing capability against the threat helicopters.

And as future weapons are brought on—for example, improvements to the current air-to-air Stinger—then they of course would be incorporated in the LHX aircraft.

Senator RUDMAN. Now is that program pretty far along in terms of what is going on right now down at Rucker in terms of bringing that up to speed? Because my information, General—I do not argue with the points you make. Obviously they are the three points that are part of any air-to-air program.

LHX FULL-SCALE DEVELOPMENT

But my question is are we doing it? Is the money anticipated within the program? Is this all being done or are these things that we would like to do but maybe will not get there? That is my question.

General ANDRESON. Sir, let me comment on the LHX part of that. The funding to develop the LHX airframe and to develop the target acquisition and also, to a degree, the interrelationship between the missiles and the aircraft mission equipment package are a part of the full-scale development program planned to begin in January 1988 on the LHX.

HELICOPTERS DEFICIENCIES

General PARKER. Mr. Chairman and distinguished Members, I am General Parker, the Aviation Branch Chief and the proponent for aviation, and I sincerely appreciate the hearing because I am considered an advocate for Army aviation for obvious reasons. So I am pleased that you have taken the subject on.

Sir, your question is a very good one, and General Andreson has given you a good answer. I would like to elaborate on it just a bit, though.

One of the very significant battlefield deficiencies we have is the air-to-air between helicopters. The Soviets have written about this as far back as the early 1972 period, wherein they indicated that the loss exchange ratio between track vehicles and our attack aircraft they believed potentially could be from 12 to 19-to-1, and that anything potentially that lethal they had to come after and they had to prepare to come after it with any and all weapons systems, a combined arms approach, if you will—infantry, artillery, armor, air defense.

But they went on to say—and we agreed—that in a future air-to-air conflict involving helicopters the best killer of a helicopter is in fact a better helicopter, not a fixed wing, not an air defense piece. I believe that they are correct on that count, and I think the record would show in the classified section we cannot talk about here they commenced work at that time on a very substantial air-to-air capability, and that is starting to emerge.

USE OF STINGER MISSILE ON HELICOPTER FLEET

We, too, have gotten busy on air-to-air and we have taken a very successful weapon system, the ground-held Stinger missile, in our air defense community. We have adapted that for Army aircraft, have a requirements document approved and we are working through the system to put air-to-air Stinger on the AHIP. We will put it on the OH–58C in the scout over-watch role. We will put it on the Apache. We will put it on the Cobra. And yes, we will even put a mix on the utility aircraft, the UH–60. And each platoon of five aircraft, too, will have air-to-air missile capability.

We have completed the developmental and operational tests very effectively with the system. Now this is the interim fix, but with the significant battlefield deficiency that we face in air-to-air clearly we had to go to work on a platform to take that on, and LHX is a strong and key player in the air-to-air equation.

We have gone for a mission equipment package on this aircraft that will technologically out-acquisition the opponent—that is our aim—and we believe that we can do that. We will find him first. We have commenced work jointly with the air defense branch working on the follow-on missile for Stinger. That missile will replace Stinger on the fleet that I have just talked to you about, as well as going on LHX.

We are looking for a multipurpose launcher on LHX that will allow it to function in the air-to-ground role for killing hard targets with Hellfire missile and whatever follows that on, soft targets with a multipurpose submunition, and also a launcher that would fire the air-to-air missile.

Now we believe that if we look back at past combat the winner in air-to-air engagements has been he who found the opposition first, and so we believe that technologically we are putting that package together. But knowing that helicopters are operating in a nap of the Earth flight profile—that means as close to the Earth's surface as possible without flying into objects—the reason being that helps mask you technologically from the radar ability to find you—there is a void there in which we can live with certain aircraft survivability equipment on board—knowing that both we and the opposition in a future conflict will be in nap of the Earth, then we are looking for a nose turret gun that is heads-up slewed to the pilot's helmet-sighting system so that as he looks in any direction the nose turret gun slews in that direction, with a fire control solution built in for the lead angles and all, and that would be for the close encounters that obviously will occur occasionally when we are both in nap of the Earth.

And so we see that we have put a very substantial piece into LHX equal, equal in effectiveness to the air-to-ground. What we need in both of those is agility and maneuverability in the airframe, and then the mission equipment package for doing the killing.

Senator RUDMAN. Mr. Chairman, thank you very much for the time. General Parker, I appreciate the answer.

Mr. Chairman, I believe that it is absolutely essential that whatever goes forward in this program, that this particular part of the program not in any way be allowed to slip because I happen to believe from talking to people who are experts in the field that if we go ahead and deploy this without that capability then we are going to have nothing for all that we spend by 1995.

Mr. Chairman, I have some questions General Garn would like to submit for the record, if I may do that for him. I thank the chairman.

Chairman STENNIS. Without objection, the questions submitted for Senator Garn will be entered in the record to be answered by you gentlemen, please.

Senator RUDMAN. I think I said General Garn. I think he is, but I meant Senator Garn, Mr. Chairman. There are too many generals out there this morning.

General PARKER. Sir, I apologize for the long answer and taking your time, but it deserved a long answer.

Senator RUDMAN. That is all right. Thank you.

Chairman STENNIS. That brings us to Senator Johnston.

LHX COSTS

Senator JOHNSTON. Thank you, Mr. Chairman.

General Wagner, about 1 month ago Secretary Taft was here before this committee and I asked the following question:

> Secretary Taft, one of the big decisions we are going to have to make is on the LHX helicopter. I understand if we are going that direction it would be about a $40 billion program.

As an aside, I understand it is now maybe $66 billion.

> We are going to have a briefing on Army aviation later on, a hearing on that, and I think it would be very useful if we could get a budget comparison on LHX as opposed to a non-LHX Army aviation. I mean, how many AH-64s, how many AHIP's, et cetera, Black Hawks. And then, of course, we could get into the capabilities.
>
> But when we try to decide whether we spend the $40 billion, we ought to decide $40 billion as opposed to how much, and then we can compare capabilities and then determine whether it is worth it. I would very much appreciate it if you would have that done because otherwise the committee would have to rely on, you know, its extraneous resources to try to figure out those costs and that would not be nearly as good.

Mr. Taft replied:

> Senator, we will make sure that that is done, because I think you are exactly right.

Now as yet I do not have that information and the information was not revealed here today. Let me say, General, that when I look at our budget situation, which is probably going to mean less money not more money, particularly if the administration continues to say no taxes and we have got to meet the $108 billion Gramm-Rudman target, it means less money, not more money.

Now here we are talking about $40 billion to $66 billion, and the problem is you start out in your statement saying that one of the biggest problems is that the Soviets outnumber us 1.6-to-1, maybe going up to 2-to-1. And the answer here is to suspend the production of helicopters for a period of, what, about 6 years while we wait for LHX, which seems to me, first of all, to aggravate the problem. Second, I am not at all satisfied yet, I am very skeptical—the case may be there to be made—that another mix of Ospreys and Black Hawks, AH–64's, et cetera, might be much more cost effective considering the huge development cost here.

AIR-TO-AIR CAPABILITY

I wonder, for example, General, I heard you talk about that we are going to put an air-to-air Stinger on there. I mean, that is going to be on the AH–64. I just wonder what it is that we get with the LHX that we do not have with these others. I mean, I know you get a little more speed. You can put in this turret and you can put in other things, but the Soviets do not really have much offensive air-to-air capability now, do they?

General WAGNER. They have a lot, sir. That is the principal reason that Mr. Rudman was asking that question. They have a considerable amount of it today; they are designing a helicopter, as far as we can determine, that is strictly for air-to-air, a dedicated air-to-air helicopter.

Senator JOHNSTON. And the Osprey would not be capable of meeting that threat?

General WAGNER. Sir, the Osprey, or the V–22 Marine aircraft, is a very large aircraft primarily for troop transport. We will be buying some of those, but they will not be used primarily in this role because of the agility, maneuverability, the fire control that they need to engage in air-to-air battle.

LHX CAPABILITIES

Senator JOHNSTON. What do you do about your capability of your contractors whose lines will be shut down—I think you refer to that in your statement—during this period of time that they are not building anything? There may be insufficient requirements for Bell to justify this facility, et cetera. It looks to me like—I mean, I understand LHX, if it lives up to all of its design criteria, would be a good machine. It would be a very expensive machine. But you are going to have a whole lot less of them than you could get with existing technology.

I am not in a position to argue with you about the capabilities, but I do not think the case has been made here. I mean, I know it is a very technical case, but I do not think the case has been made to justify this expenditure of money considering the very great deficiencies which we will knowingly create for ourselves in this 6-year down time in production and the already insufficient numbers we have as compared to the Soviets.

COST AND OPERATIONAL EFFECTIVENESS

General WAGNER. The case was not made today, sir, because we are running the most extensive cost and operational effectiveness analysis we have ever run on any program in the Army or, for that matter, I think, has ever been run on any program in the Department of Defense. That is to answer those questions that you mentioned first that you brought up to Mr. Taft.

That study arrived in Washington last Friday. We have been working on it since that time. It does answer almost all of those questions you asked. It looks at this point that when we compared it with all of those options—current aircraft, buying more of those, various mixes--and we looked at five or six various combinations to even include improving the current aircraft—that is very cost effective.

We did not bring that over here today because the Department of Defense must put the emerging results in terms that lays that out for you. Additionally, we have to get it approved by the Department of Defense before we can provide the emerging results of the cost and operational effectiveness analysis. It will be brought over to the members that are interested and to the committee staffers within the next 2 weeks. That is essential. We will not make a decision ourselves until the emerging results are complete.

As far as numbers, we cannot buy more of the current aircraft than we could buy LHX if the LHX comes in at the cost that it looks like it is going to. We also have had a very thorough cost analysis. That is in the hands now of OSD and as soon as they approve that and say it is right or wrong or if it is in the ballpark, it will be provided to you, too. We expect that within the next 2 weeks.

Senator JOHNSTON. Now tell me about why this air-to-air is so important. I am not arguing with you; I just want to know because it would just seem to me that when you are in a battlefield situation flying nap of the Earth that air-to-air would not be nearly as big a problem for you, as big a threat to you in a helicopter as would be ground-to-air.

HELICOPTER THREAT

General WAGNER. Well, you have the threat from all of those enemy aircraft on the battlefield. The problem we have is, if you come up on him in attack aircraft or if he sends out large numbers of hunter-killer teams that are after your helicopters with his dedicated air-to-air aircraft, you have to be able to engage him. We took a very, I think, narrow view in the past when we said that we had to be ready to only fight defensively on the air-to-air battlefield. If fired on, you shoot back.

We have found in all the recent studies we have run and actual experimentation in the field, both in the Army and Marine Corps, that a helicopter is a very effective weapon system against another helicopter, particularly with the advanced acquisition system that we have on it today to pick him up and fire on him.

Senator JOHNSTON. My time is up, but I would like to get a briefing on these capabilities sometime privately, if you would.

General WAGNER. We will provide that for you, sir.

Senator JOHNSTON. Thank you.

Chairman STENNIS. All right. Senator Weicker, you are next.

WEICKER PROPOSAL

Senator WEICKER. Thank you very much, Mr. Chairman.

Gentlemen, as you can tell there seems to be a great concern among all the members of the committee relative to this gap as between the LHX, the arrival on the scene of the LHX, and the shutdown existing production. I must confess I do not understand why we cannot be producing and developing helicopters simultaneously.

Let me introduce a proposal for your comment. We have gone over the ground as to where we sit. Let me throw out a proposal and let you comment on it.

I would like to hear your reaction to this type of proposal which, as I say, allows for both procurement and development to go on simultaneously.

General WAGNER. Sir, I cannot comment specifically on those numbers because I can only ballpark them, but they sounded roughly in the ballpark. Obviously 1988 is the easy problem. It is 1989, 1990 and as we go out that becomes the difficult problem because it gets up to $1 billion to $2 billion a year to keep those production lines open.

Stretching the LHX only means that if you do not want a production gap at the end you are going to have to keep them open longer at a higher cost and, second, it means that we are going to have 80 percent of our fleet that is not going to be modernized while we are buying these new ones.

If we had the TOA, as I said at the very beginning, we would like to keep the production lines going and bring in the LHX, which we think is necessary, on time. It was just the problem that we did not have enough money to do it all.

MODERNIZATION PROGRAMS

Senator WEICKER. Of course, the problem I have is that modernization is something you have tried to achieve but, in essence, you have not achieved even with the present lines. Am I correct?

General WAGNER. That is correct, sir. I will say in retrospect, however, that we never, until the last 3 years, intended on buying over about 515 of the AH–64's. Again that might have been shortsighted because this is a very outstanding aircraft and if we had had dollars we would have bought more. We would then increase that number to 675. We are not able to buy that number when we had reductions in the budget and other reductions in the last 2 years which pulled us down. That is the reason we cut it off.

As far as being fully modernized, no, we are not, and we would never have been fully modernized.

Senator WEICKER. You mean fully——

General WAGNER. Up to the 1,031 is what you are speaking of, I think, sir.

Senator WEICKER. Well, I am going to submit the proposal for the record, and you might want to go over it more carefully and give your response for the record on it.

General WAGNER. Yes, sir, we will.

[The information follows:]

WEICKER PROPOSAL

Question. Continue producing UH-60's and AH-64's at close to current rates; continue upgrading OH-58's (without mast-mounted sight); begin development of advanced B models of UH-60 and AH-64:

Fiscal year 1988 budget increases: Add $250 million for 35 more UH-60's in fiscal year 1988 and 19 more in fiscal year 1989; add $220 million for 5 more AH-64's in fiscal year 1988 and 72 more in fiscal year 1989; add $55 million for 36 OH-58C plus conversions in fiscal years 1988-89; add $10 million in R&D funds for UH-60B; and add $25 million in R&D funds for AH-64B. Total: $560 million.

Fiscal year 1989 budget increases: Add $1.2 billion to continue initiative.

Continue LHX R&D but at slower pace. Fiscal year 1988 request: $402.3 million; $135.1 million for T-800 engine; $267.2 million for LHX. Leave engine portion intact; LHX reduction—not determined; and LHX focus—composites and avionics.

Apply portion of LHX money to production programs; derive balance from other sources—SDI et cetera.

Answer. Each proposed increase by Senator Weicker has been considered by the Army and is desirable, but unaffordable within the current funding restraints. The Army estimates include the necessary equipment to field units, which coincides with the dollar estimates in Senator Weicker's proposal. The program is unaffordable under current funding constraints because approximately $1.2 billion is not only required in fiscal year 1989, but also in fiscal year 1990 and fiscal year 1991 when the UH-60 fielding is currently planned to be completed. An estimated $2 billion is required annually from fiscal year 1991 to fiscal year 1995 when the LHX is planned to be fielded. If the LHX pace is slowed down, this problem is stretched and costs are increased. The Army does not concur in slowing the pace of LHX development as the system is essential to the modernization of 80 percent of the Army's aviation assets and the rapid fielding of this system is needed to minimize the overall costs to the Government.

LHX COSTS

Senator WEICKER. But I am deeply concerned. I am not even here to get into an LHX debate. Your cost estimates are already starting to rise on that, as I predicted they would a couple of years ago, but in the meantime what bothers me even more than the eventual cost of the LHX is that the Army is not getting on with the process of modernization now, even assuming we have an LHX at some future time.

And I think that obviously has been expressed in different ways by everyone here.

Thank you very much, Mr. Chairman.

Chairman STENNIS. Thank you, Senator.

Senator Cochran, that brings us to you, sir.

Senator COCHRAN. Thank you, Mr. Chairman.

Let me welcome the panel of witnesses who are before the subcommittee today. I am hopeful that we can find the funds in the budget within the constraints that we have to work on this year to be sure that the Army has an operational fleet of aircraft that help protect our forces in the field and do the job that the Army has to do.

I am concerned about one aspect of the statement and budget request that is before the committee, and that has to do with the level of funding for aircraft for our Reserve and Guard forces. Last year, when Secretary Marsh was before our committee, he talked about the fact that the Reserve and Guard components were being called upon to share almost on a 50–50 basis a lot of the missions and mission requirement responsibilities of the regular Army.

AIRCRAFT REQUIREMENTS

Then, in the statement there is a comment about recent requirements to provide UH–1 aircraft for foreign military sales and drug interdiction have had an impact on Reserve component unit readiness levels. That raises a question in my mind as to why the Reserve and Guard are having to have the aircraft taken out of its readiness. Who is deciding that foreign military sales take priority over Guard and Reserve readiness?

General **Wagner**. Sir, those that went to foreign military sales—and I would have to provide the specific number—went to very high priority missions among some of our allies and they were then diverted from the lowest priority, latest to deploy units in our Reserve component.

Sufficient aircraft do remain in those Reserve component units so that they can train properly. They just do not have the total number they would require if they went to war, and that means if they deployed later we would have to fill them with aircraft before they go.

You might want to add to that.

General **RisCassi**. Sir, the only thing I can add to that is that some of the models that we have been selling as a foreign military sales aircraft is a deployable airframe. The numbers, again, I do not have at my fingertips, and we would have to provide that to you.

DRUG INTERDICTION ACTIVITIES

Senator **Cochran**. What about the drug interdiction activities? Why does that detract only from the Reserve and Guard readiness?

General **RisCassi**. Sir, the type of aircraft we are talking about is the UH–1 model.

General **Wagner**. It is just the lowest priority, sir, the same reason.

Additional money has been provided to buy four Black Hawks for that purpose, but they will not come out of the Army inventory because it is above the Army appropriation to buy four Black Hawks for that purpose. That should solve the problem of any more coming out for drug interdiction, since they are buying dedicated aircraft for that purpose and have that in their own programs. It will not come out of the Army any more.

AIRCRAFT USE IN INTERDICTION

Senator **Cochran**. To what extent are regular Army aircraft being utilized in the drug interdiction effort?

General RisCassi. We have provided three Black Hawk airframes to support the current Operation Hat Trick in the Southeastern part of the United States. We have supported with a total of six Black Hawks and, on and off, some CH–47's in the Bolivian drug operation, but they have all returned. From three to nine airframes at any one time have been devoted to drug operations in separate and distinct operations.

Senator Cochran. Two years ago I recall that our Appropriations Committee wrote into its bill some language earmarking a certain percentage of funds, or maybe it was a dollar amount—it was a dollar amount of funds—for the Navy, the air component of the Navy, to fly missions specifically in the drug interdiction effort. Has that been done at all by our committee in the past with respect to Army missions?

General RisCassi. Sir, I cannot comment on that.

Senator Cochran. I wonder whether or not that would be a way to get at the problem. What is your reaction to that?

General Wagner. Well, if they are flown by U.S. Army crews, it means they are not available for our purposes, but that does not mean that they are not getting training when they are doing that. They are flying. But all of the committees have now appropriated money, as I said, to buy four dedicated aircraft for this purpose.

DRUG INTERDICTION EFFORTS

Senator Cochran. There is a resistance, and we all understand it, on the part of the armed services generally to becoming involved with the drug enforcement agency or the U.S. Customs Service in these efforts to do something about sharing of assets in the battle against the drug smugglers. But I was told that the operation in Bolivia was an excellent training experience for those who were involved in it and that it might be inappropriate for the armed services to continue to resist, as I hear they are resisting—and maybe I am wrong about that, but I hear they are—the involvement in the drug interdiction efforts.

What is your understanding of the value of the training experience that was obtained in the Bolivian exercise?

General Parker. Sir, I will respond to that very briefly. Yes, when we use our crews as we did in that operation they do derive good training benefit from it. I would not characterize at least the Army's position as being one that has tried to keep from getting involved in that. We have not gone out and volunteered to participate in it simply because we have identified tasks and developed those in an aircrew training manual and the individuals are required to do certain maneuvers over a period of a year in order to stay combat-ready.

And we can get some training that would apply to those training requirements, but we are not able to do it all if we are tied up on an operation like that.

REQUIREMENTS

Senator Cochran. There is a table that you have included in your statement to the committee on page 12 that is entitled "Requirements," and I am a little confused by it because it has a note at the bottom defining requirement as not including unresourced force structure which the Army cannot afford.

I wonder whether or not this is to be considered by the committee as real requirements or just requirements that the Army has considered it can afford. I mean, we have a lot of requirements we cannot afford. Is that a new definition that we ought to know about, or should there be a revised version of the table included to show what the real requirements are as compared with the requirements that can be afforded?

General WAGNER. Sir, the problem you get into on this—as I explained it a little earlier in the briefing before you arrived—there are requirements that we would like to fill given unconstrained resources, unconstrained dollars. It is always greater than what the authorized force structure is for the services.

In the past we developed what we call the authorized acquisition objective which laid out all of these, but it was not realistic because if you do not have people in those units, if you do not buy all the other equipment in those units and do not ever plan on resourcing them, it does not make any sense to buy aircraft to put in those units. That is the reason we backed it out, and we have shown you the requirements we have for the force structure that we have in the Army and are projecting to have in the Army through 1993.

Senator COCHRAN. Thank you very much.

Thank you, Mr. Chairman.

Chairman STENNIS. Thank you.

Senator Proxmire.

Senator PROXMIRE. Thank you, Mr. Chairman.

BUDGETARY CHANGES TO MEET AIRCRAFT NEEDS

General Wagner, if the Congress used its sequester process in fiscal year 1988 to meet the $108 billion deficit target and CBO is correct, then we will have to find $61 billion in outlays to do this with a 14-percent across-the-board reduction in the Department of Defense outlays and 20 percent in nondefense.

AIRCRAFT BUDGET RESTRAINTS

Just where would you make a 14-percent outlay cut in your aviation budget and what impact would that have on our national defense from your Army aviation perspective?

General WAGNER. It depends on how the rules worked on that; if we followed the current rules it would have to be sequestered equally across all programs. That would have a substantial effect on this program because, as you know, of the outlays there may be only one-seventh in that first year for appropriation. It would almost destroy our aviation program if we had to take it all out of that.

It would break all of our contracts because if you had to take out seven to eight to one to save every dollar in outlays. We would have to go back and renegotiate every contract and reduce the number of aircraft we were buying. And it is not just true in those programs, sir. You know, that would be true in the majority of our programs.

Senator PROXMIRE. It would add substantial cost over time?

General WAGNER. Absolutely, sir.

Senator PROXMIRE. Can you give us some notion of how much the additional cost would be?

General WAGNER. Yes, sir. I have got a chart here. For example, on the AH-64 if I produced at six a month, it costs me $13.6 million per unit cost for one aircraft. If I drop that to the minimum sustaining rate of 3¼ a month, which would be 39 in a year, it goes up $1 million for every one of those aircraft. If I was up at the best economic rate, which would be 12 a month or 144, it goes down to $12.4 million an aircraft.

COST OF TERMINATING CONTRACTS

Senator PROXMIRE. Well, that is the unit pricing part of the issue. How about terminating contracts? Isn't there a penalty payment you have to make in that case?

General WAGNER. Absolutely, sir.

Senator PROXMIRE. And what would that be, roughly?

General WAGNER. I cannot give you that.

Senator PROXMIRE. Can you give us some notion of how big? Would that be $1 million a copy or what?

General WAGNER. Sir, I think these costs might be approximately correct on the Apache, for example, because that is not a multiyear contract. That is a single year, annualized contract and they probably would not go up much.

If you got into the Black Hawk, where we have had substantial savings by going to multiyears, for example in 1985–87 we saved $129.5 million it would be greater. If we went into 1988–90 when we would like to have another multiyear contract, it would be very difficult to negotiate one and those costs would go up considerably.

Senator PROXMIRE. That leads me right into the question I wanted to ask you. In fiscal year 1987 you planned to purchase 82 UH-60 Black Hawk helicopters in fiscal year 1988. In fiscal year 1988 that buy is down to 61. The unit price last year was $5.2 million; this year it is $6.5 million, or an increase of $1.3 million each. That is a 25-percent increase per helicopter.

Another way of looking at this is we are getting 25 percent fewer helicopters for only 7 percent less money. Is that a good deal for the taxpayers, 25 percent fewer helicopters for only 7 percent less money?

General WAGNER. No, sir; we would like to buy at higher, more productive rates and save the dollars. Incidentally, we think we can.

Senator PROXMIRE. Are those figures about right?

General WAGNER. I believe those were annualized prices, and I would have to check with your staffer to make sure. We think we can still get a multiyear, even at the 61, over a 4-year period, and can have some savings—not as much as on the previous one because obviously we are not buying as many aircraft. But, you always want to buy at a higher production rate and then get a multiyear contract.

APACHE HELICOPTER

Senator PROXMIRE. Now let us look at the AH–64 Apache helicopter. In fiscal year 1987 you were provided $1 billion for 101 helicopters at $10.6 million each. In fiscal year 1988 you will buy 67 helicopters at $692.8 million, or $10.3 million each. Why is the unit price actually reduced for the Apache given a reduced buy when it has gone up for the Black Hawk?

General WAGNER. I will have to provide the details of that for the record, sir.

General PARKER. Sir, may I comment on that?

Senator PROXMIRE. Yes, General, go ahead.

General PARKER. Sir, we used some of the money to buy modifications that clearly needed to be made to that fleet of aircraft—wire strike protection equipment, the blue-green lighting for the cockpit for the compatibility with the NVIS night vision system. That helped decrement it, and, of course, just the affordability of distributing our TOA across the force.

Senator PROXMIRE. I do not think I made myself clear, General. The unit price went down, not up. It went down. You had in 1987 you were provided $1 billion for 101 helicopter at $10.6 million. Now the buy went down to 67 helicopters, and the price went down too. Under those circumstances I would think the price would go up, No. 1, because you were buying fewer and, No. 2, because you had additional costs there or you were buying additional parts for your helicopter.

General WAGNER. It may be the learning curve, sir, but we have not negotiated that yet and whether we can buy them at that cost is a big question.

Senator PROXMIRE. So there is at least that counteracting element, a learning curve.

General WAGNER. That has something to do with it, sir, but until we can get out and actually negotiate, we won't know. We did not get the price last year we thought we would.

Senator PROXMIRE. I will tell you, for the record, General, would you break this down a little more and let us know how much of this was learning curve and so forth, because it does seem to be a spectacular contradiction.

General WAGNER. Yes, sir, we will.

[The information follows:]

AH-64 (APACHE)

The lower cost resulted from not reducing the production rate of 12 per month for the buyout of 67 aircraft in fiscal year 1988. The lower unit cost was, therefore, a result of moving further down the learning curve.

PROGRAM STRETCHOUT

Senator PROXMIRE. When you are given instruction by the Secretary of Defense and OMB that Army's procurement budget submission to DOD has to be reduced, why don't you terminate programs instead of stretching them out? After all, stretchouts are no long-term bargain for the taxpayer and certainly no benefit to the force structure. Why not make priorities, drop a few programs, and keep higher production levels with the higher priority programs?

General WAGNER. We did, sir. We terminated the AH–64, and we terminated the AHIP. On the combat side we have terminated the FAASV vehicle. So across the board we have had to make some terminations.

Senator PROXMIRE. Well, my point is that you are still stretching out production, however. It seems that you have got to make it as painful and difficult and you still have to stretch out a little more. I mean, you still have to decide on your priorities a little more carefully and knock out maybe one or two others.

General WAGNER. Sir, I agree with you, and the reason these were knocked out, as I explained earlier, was so that we could buy such things as the mobile subscriber equipment [MSE], where we have tremendous deficiencies in command and control and communications on the battlefield, at a very efficient rate. As those then are finished we are going to cut them off at the end of 5 years and start buying aircraft again.

But you have heard the testimony today. We just could not afford to keep all these lines going, and that is the reason some of them fell out.

Senator PROXMIRE. My time is up, Mr. Chairman. Shall I go ahead?

Chairman STENNIS. Yes.

Senator PROXMIRE. I have one or two other questions. I appreciate it.

CESSNA SKYPLANE

Why are you requesting funds for two Cessna Skylane aircraft and what role do they play in your force structure?

General WAGNER. Sir, those aircraft are instructional aircraft at the U.S. Military Academy. They are used in the Department of Mechanics to give aeronautical training to cadets. That is a specific type of aircraft that it shows; however, when we go out on the market I am sure that we will compete those and get the best buy we can.

AH-1 COBRA HELICOPTER

Senator PROXMIRE. Now, last December the Army grounded 750 of its AH–1 tank-killing Cobra helicopters because cracks were discovered in the rotary assembly component of the three aircraft. What is the status of the safety inspection being performed on these aircraft and what have you discovered from that inspection?

General WAGNER. Sir, that inspection is completed. All of the aircraft are up now. I believe it was some bolt problems that have been corrected and replaced.

AIRCRAFT'S SAFETY

Senator PROXMIRE. Last November we had reports that there were life-threatening safety problems with the turbine engines that power hundreds of aging OH–6A Cayuse and OH–58A Kiowa light scout helicopters. What has the Army done about those problems? As I understand it, this problem results in the engine gear box being destroyed and the pilot has no warning of an impending catastrophe.

General PARKER. Sir, let me respond to that question. The allegation that that has occurred, I recognize, has made the media. I have looked at the accident rate of that fleet of aircraft that allegedly have that engine and I do not find any alarming trends when you compare it to the other members of the Army aviation fleet. We are looking at it because the allegations are out. We are studying it simply because of the age of some of those components.

And I can go back and show you where we have had a couple of failures. But when I look at the number of hours and the period of time in which those occurred, I could probably select any number of other singular items and show that we had had that many or more failures on other types of fleet.

LHX COST

Senator PROXMIRE. As you know, there is a good bit of concern in Congress about the light helicopter experimental, the LHX, the Army wants to build, which would cost $66 billion. Many of us believe the close air support mission could be performed for a much lower cost than LHX. There has been a proposal floating around the Pentagon for a turbo-prop-powered aircraft to perform the close air support mission instead of the LHX.

Since this aircraft would cost $20 billion, not $66 billion, like the LHX, and would most likely outperform the LHX, would you care to comment on the idea of building a turbo-prop-powered aircraft instead of an LHX?

General WAGNER. Sir, that study will be run and has been looked at by the Department of Defense. That was not one of the options that we had in our cost effectiveness analysis because that is not an Army mission.

Senator PROXMIRE. That is an astounding number, $66 billion.

General WAGNER. Sir, that $66 billion is based on buying 4,000 or so. We are not sure of the specific number yet, and we will be providing the emerging results of the cost analysis that has just been completed on the various numbers in the near future. That is escalated dollars. It goes well past the year 2000. That study will be coming in here within the next 2 weeks.

General PARKER. Sir, I would also add that dollar figure can be misleading. We are replacing that obsolescing fleet that we talked about a few minutes ago, of which 76 percent of it is 17.5 years average age. We are replacing that with LHX. Now if we take just the technologies that we could strip off LHX and put onto another existing airframe, we can show you costs that will exceed the LHX cost projections, and I think we will show you that clearly when the emerging results of the cost and operational effectiveness analysis comes up.

Senator PROXMIRE. The $66 billion?

General PARKER. Yes, sir.

General ANDRESON. The $66 billion is two components—the R&D program of about $2.5 billion, and a 4,500 aircraft LHX production, of which 2,000 are SCAT's and 2,500 are utilities. Now those are the costing numbers that make up that estimate, and, as General Wagner said, that includes all of the escalation, of course, between now and the final production of LHX out into the 21st century. In constant dollars, constant 1984 dollars, which the program is structured in, that is about $40 billion.

Now obviously if fewer numbers of LHX's are to be procured, then those costs go down. However, let me state that those unit costs, just to reinforce what General Parker said, are significantly less than you would incur by incorporating the LHX level of technology into any existing platform.

Senator PROXMIRE. For this Army helicopter the Congress will have to appropriate $66 billion over the next what, 15 years?

General ANDRESON. Well beyond that sir. We are out 20 to 25 years. And in those numbers, of course, is over——

Senator PROXMIRE. If it is 20 to 25 years we ought to put it in 1987 dollars, I presume.

General WAGNER. Probably $40 billion.

General ANDRESON. It is about $40 billion, sir, in 1987 dollars. What you will see in the emerging results of the COEA is the dollars couched in terms of 1988.

Senator PROXMIRE. You are an optimist. There is nothing you can do about it. I do not mean to be nitpicky here, but when you say $66 billion, it could be $100 billion or $200 billion, depending on inflation.

General ANDRESON. Well, of course if inflation is significantly out of line with what is carried in our current estimates that would make the result different, sir.

General WAGNER. If you put in inflation it is very hard to give you an estimate.

LHX UNIT COST

Senator PROXMIRE. Can you give us the unit cost in current dollars and inflated dollars?

General ANDRESON. Yes, sir; the unit cost in fiscal year 1988 dollars as opposed to the program goal is $8.8 million for the scout/attack and around $6 million for the assault, which is often referred to as just the utility version.

Senator PROXMIRE. What is it in inflated dollars again? Add another 50 percent on that?

General ANDRESON. You would add essentially 50 percent, sir.

Senator PROXMIRE. So that would be around $12 million.

General ANDRESON. Around that, but then you are looking at the average costs over the next essentially 30 years of the program, 20-some years of production and 6 years of development.

General WAGNER. For example, sir, to put that same mission equipment package to give roughly an equal capability into an AH-64 would probably make it cost $2.5 million to $3 million more than LHX would, and it would not have the agility and capability on the battlefield because just the size of it and the way it is integrated into the LHX makes it more effective.

General ANDRESON. Just to reinforce that, sir, we estimate that an Apache configured with the mission equipment of the LHX would cost around $12 million, or about 50 percent more than the LHX scout/attack and, of course, you never quite get there on performance because you are still limited to Apache air speeds. You are still limited to radar cross sections that the aircraft has and other characteristics.

General PARKER. Nuclear, chemical, overpressure. You just cannot transfer all the technologies but if you transfer the ones you can and you cost out the integration it exceeds the price of buying the LHX version.

Senator PROXMIRE. I have one final question, Mr. Chairman.

LHX COST EFFECTIVENESS ANALYSIS

The Congress has not released any 1987 money for the light helicopter, LHX, research pending release of the cost effectiveness analysis. When will you meet that requirement so that Congress will have that in hand and can make the release?

General WAGNER. We hope to have the emerging results of the cost and operational effectiveness analysis here within the next 2 weeks, sir. We have requested the committees to release some dollars for us to keep this program going through May, about $25 million, starting back in December and on through May. In fact, right now we have had to issue orders to the contractors that they have the authority to stop work if necessary.

General ANDRESON. Sir, General Wagner was referring to the emerging results of the COEA. The specific language, of course, requires Secretary Weinberger to certify the program costs. In my discussions with the OSD cost analysis group who does that sort of certification they anticipate that they will not release their report until the milestone 2, which is full-scale development review scheduled for April 23 with Mr. Godwin and the members of the Defense Acquisition Board.

Senator PROXMIRE. Mr. Chairman, I ask unanimous consent that questions I have from the Majority Leader, Senator Byrd, be submitted and responded to.

Chairman STENNIS. Without objection the questions offered by the Senator from West Virginia, Mr. Byrd, will be admitted into the record for answering purposes, and I call that to your attention, gentlemen.

Senator, a few minutes ago you were referring to figures there about the cost. I did not catch it clearly whether you were saying millions or billions.

Senator PROXMIRE. I was saying billions. That is what startled me. We play around with millions and billions, and pretty soon it will be trillions, but it was billions, and it was corroborated by the generals. It was billions with a "b."

Chairman STENNIS. All right. Well, I think that makes it clear.

We have certain questions here from Senator DeConcini, additional questions. He had to leave. And I have some additional questions here that I would like to submit for the record. Without objection to those two, they will be admitted to the record for answering by these witnesses.

Now, gentlemen, I think these facts impress anyone. If a person is not impressed by these figures and other items, too, he is asleep or something is the matter with him otherwise, and it shows the value of the hearings. It is both a privilege and a duty of all of us, you included, and those of us that are in the committee, in the Senate, to know something about these facts and have an understanding of them and then to act on them.

There is much valuable testimony here within these folds, and I think as I understand there is none of it that is classified. It all can be released; is that correct? The testimony you gave and the statements you made, as far as you know are not classified and can be released?

General WAGNER. That is correct, sir. There was an insert to our statement for the record that is classified confidential, which is the inventory of aircraft. That is classified and it is marked.

Chairman STENNIS. Very well. Let it be so marked. I ask the staff to let it be so marked so there will not be any mistake about that.

Do the staff members here know of anything else that should be said in reference to this subject matter on the classification or the lack of classification?

Well, as I say, it is a very valuable hearing, and I predict that there will be additional hearings about this because it stirred up things that were not known generally, to this extent at least, and we will doubtless require another look and comparison.

Representing the committee, I want to especially thank the attendance here today. Those that were here in attendance, it is about the best-behaved crowd I have seen in a good while.

That is important. It is important. You are making a contribution when you helped out by keeping quiet and learning something yourselves. If any of you are interested in reading this testimony when it finally gets in printed form, in booklet form, why we will be glad to supply any of you that might want a copy of it. Just don't all of you ask for the same book.

But there are lots of valuable findings here and we will deal with them in time the best we can. That is about as far as I can go now. Is there anything else that any of you wish to say?

General WAGNER. No, sir; we thank you for the opportunity to come over today.

Chairman STENNIS. Well, we thank you not only for your services today but your services every day—every day and every night. We appreciate it.

STATEMENT ON EQUIPPING THE ARMY

At this point in the record, we will insert a statement on equipping of the U.S. Army.

[The statement follows:]

THE ARMY'S FIRST PRIORITY

THE SOLDIER

DEPARTMENT OF DEFENSE

DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 20310

February 27, 1987

Members of Congress:

The Army's pursuit of modernization and a balanced materiel acquisition program is underway to meet the goal of equipping our Army to respond to a constantly changing worldwide threat. Force modernization, approximately one third complete, is essential in an Army that has little choice but to capitalize on advanced technology. If today's research and development is to bear fruit in the future, the effort must focus on achieving key operational capabilities in less time with fewer false starts. The Army's primary focus on five Key Operational Capabilities (Command, Control and Communications (C-Cubed); Reconnaissance, Surveillance, and Target Acquisition; Battlefield Sustainment; Battlefield Lethality and Soldier Performance Enhancement) will insure we have the materiel to fight and win in the twenty first century. We will continue stressing the procurement of off-the-shelf "non-developmental" systems to insure a reduction in equipment fielding times and savings in development costs.

The following introduction provides a brief overview of the research, development and acquisition objectives and ongoing efforts to meet these objectives. The weapons systems and other equipment are arranged to correspond to our war fighting doctrine--AirLand Battle--and are designed to show the current strengths and weaknesses to implement this doctrine. Our hope is that the enclosed discussions will make the Army's request for each system meaningful by describing its intended use on today's, as well as tomorrow's, potential battlefield.

In addition to this statement, we are also making available to you the "1987 Army Weapons Systems" handbook, a consolidated reference for a number of our weapons systems.

It is an honor to represent the Army in working with this session of the 100th Congress.

Louis C. Wagner Jr.
LOUIS C. WAGNER, JR.
Lieutenant General, GS
Deputy Chief of Staff for
Research, Development and
Acquisition

JR Sculley
J. R. Sculley
Assistant Secretary of the Army
(Research, Developmemt and Acquisition)

INTRODUCTION

This year for the first time, the Army is submitting its budget request for two fiscal years. One of the primary motivations is to provide a more stable environment for the process of acquiring equipment for the Army's number one asset, its soldiers. The Congress has been supportive of our efforts to date, and we thank you for this support. We request your continued interest for equipping the finest fighting force the world has known. We recognize that this is expensive, and in a period of declining fiscal resources we rely on your desire for a secure America to continue our programs.

The request for research, development, and acquisition funds in FY88 is $21.7 billion dollars, and for FY89 it is $22.6 billion. These funds will increase near term readiness, will continue the modernization programs already begun, although at a generally slower rate than desired, and will enhance the efforts of the research and development base to provide for future capability. The equipment acquired with these funds will reduce battlefield deficiencies that currently exist. Although we have made great strides in providing the necessary day-to-day items needed by line units, there are still shortages which must be corrected.

The requirement to equip our forces with modern weapon systems looms even more significant when considered in light of the threat. In recent years the Soviet Union has accelerated its rate of production much more than we anticipated. This has compounded the numerical advantage which they already held. In addition, they are now beginning to rapidly close the qualitative edge which we relied upon to offset the quantity deficit we will always suffer. The Soviet and Warsaw Pact forces have fielded modernized motorized divisions and armored divisions, dense air defense systems, and modern attack aircraft and helicopters at accelerated rates. Their conventional theater missile capability grows daily.

To illustrate the gravity of the situation, one need only consider the production of several major systems by each side. For the past three years the Soviets have produced approximately 3100 main battle tanks per year to our 726, 5400 personnel carriers to our 700, and 720 helicopters to our 180. In addition, the equipment they have been producing has displayed vastly improved quality over their earlier systems. New models of their tanks, for example, appear about every 5 to 7 years.

The fact that the Soviet Union was producing more and better equipment has been known for some time. Decisions made in the early 1970's by the Army's leadership led to the current fielding of the "Big Five"—the Abrams Tank, the Bradley Fighting Vehicle System, the Black Hawk and Apache helicopters, and the PATRIOT air defense system. These systems are providing a quality edge once again in these areas. We should not let the fielding plans slow in these vital area. Likewise, we should not fail to capitalize on the benefits of investments previously made in the technology base to produce modern equipment. To counter the Soviets, our research and development programs now ready for production and fielding must be supported for two reasons:

- First, a strong, well trained and modern conventional force will reduce the necessity for escalation to nuclear weapons by our side. As long as our conventional forces are capable of deterring the Soviets we will not quickly be forced to resort to nuclear weapons.

- Second, should tactical nuclear weapons be reduced or disappear from the battlefield, the remaining conventional defenses must be modern and sufficient in numbers to deter all aggressors.

We stand poised to sustain our modernization efforts. We feel this is essential. We have used several principles in guiding our efforts to reach this point.

The SOLDIER is the fundamental focus of all our research, development, and acquisition efforts. The Army equips soldiers—we do not "man" our equipment. All our efforts are to provide the soldier with equipment which will allow him to fight, if necessary, and to win that fight.

To ensure that the soldier remains the central focus of our modernization, we have instituted MANPRINT, the manpower and personnel integration program. This program seeks to integrate the full range of human factors engineering, manpower, personnel, training, health hazard assessment, and system safety to improve soldier performance and total system performance throughout the entire materiel development and acquisition process. A complete MANPRINT assessment is required on all major programs, and is a consideration in all of our other development efforts.

The weapon systems being developed for our modernization program are by necessity more lethal than the systems they replace. Munitions programs are developing warheads which can penetrate the greater armor of current and future Soviet armored vehicles. These and other armament enhancement initiatives are directed at making the entire force more lethal. Smart munitions will be able to fly to precise locations and destroy specific targets. This advance is possible by the incorporation of microelectronics within the munitions themselves.

We are making a conscious effort to down-size all new equipment being developed. This means we are making the equipment lighter and smaller as well as more lethal. The use of composite material and plastic in armor plate may allow us to produce a nonmetallic armor which has a weight savings of 15 to 20 percent. The advanced field artillery tactical data system (AFATDS) now in development will be considerably smaller as well as much more capable than its predecessor. Large computers are being replaced with smaller and more portable ones. One of the advantages of size and weight reduction of the force is that it enables us to operate with our sister services more effectively. Strategic mobility is provided by the Navy and the Air Force; and with a smaller and lighter force, the Army's deployability is enhanced.

This "jointness" of operations with others extends beyond the physical aspects of deployability. Integration is required in areas like command, control, communications, and intelligence equipment. This applies not only in the Army, but to the other services, and to our allies.

The supportability of our modern equipment as well as currently fielded items is critical. The most lucrative area for future cost savings to the Army is in the area of operations and support cost avoidance. Designing for producibility and sustainability is emphasized in all programs. For fielded systems, modifications to increase supportability and increase performance are being pursued.

With these principles as our key goals, we are continuing to work toward the ultimate objective of providing our most important asset—the soldier—the equipment needed to perform in the most effective manner. When we field a major item of new euipment we do so by Unit Sets. This method has now been thoroughly incorporated into our materiel acquisition process to ensure effective implementation of our modernization program. The unit set fielding process ensures that distribution of a new piece of equipment is accompanied by all the ancillary and support equipment, all the individual, crew and unit training packages, and all the munitions needed to make the weapon effective upon receipt.

We now are applying the logic of unit set planning even earlier in the process of resource allocation. It is important to remember as you review the weapon systems which follow that they are truly "systems" which gain their full value only when fully intergrated and supported in the combined arms Army. Changes in a major system will necessarily require changes in ancillary and support equipments to insure a balanced and effective modernization program.

The Army is not standing still. Modernization of the force is real and must be completed. We must diligently conduct research and development for the future at the same we are improving our force through acquisition of new systems. To control this monumental task requires that we all work together to provide the equipment needed to perform in a most effective manner. The RDA Community is totally dedicated to this effort.

TECHNOLOGY BASE

Major weapons systems and other equipment products of the Army Research, Development, and Acquisition (RDA) program are the highly visible end products of the RDA process. Less visible are the research and development (R&D) efforts prerequisite to equipping the soldier with the necessary systems and equipment to defeat the threat. Those efforts are conducted as part of R&D that is called the "technology base". Technology has changed the modern battlefield of today. It has enabled, for example, increased firepower and mobility, improve surveillance and target acquisition, greater potential for concealment and surprise, increased battlefield survivability, and dramatically improved medical care. It has also given the individual soldier a capability to increase the size of the battlefield he can influence by virtue of such technologies as electronics and nigh vision. Other by-products of this technological change include increased information flow during continuous operations over an extended, integrated, highly lethal battlefield. Between now and the 21st Century, we must be prepared to fight this battle with soldiers that have already been born and many of the Officers and NCOs that are in the Army today. Given constraints on manpower levels, increasing sophistication of weapon systems and increasing battlefield synchronization requirements, the Army must capitalize on technology to do more, with fewer personnel, in less time.

The FY87 Army posture statement described the Army focus on five Key Operational Capabilities to apply high leverage in areas of particular interest to the Army. The Army will continue to apply that focus on these key operational capabilities in a deliberate, disciplined approach to exploit our national technological advantages in areas such as microelectronics, computers, biotechnology, aviation, and artificial intelligence. Cutting across all five key operational capabilities are our needs to lighten the force, achieve battlefield synchronization, and pose a deep attack capability. To help achieve these objectives, the Army has identified twenty technology demonstrations which we believe are vital to our technology integration efforts: Advanced Mine/Countermine; AirLand Battlefield Enviornment; Army/DARPA Distributed Communications Processing Experiment (ADDCOMPE); Aided Target Recognition/Multi-Sensor Fusion; Biotechnology; Combat Vehicle Armor/Anti-Armor; Crew-Vehicle Interface; Elevated Target Acquisition System; Electromagnet Launch/Liquid Propellant/Unicharge; Expert System for Combat Vehicles Diagnostics/Prognostics/Embedded Training; Integrated Air-to-Air Weapons; Lightening the Soldier's Load; Lightweight, Indirect Fire Weapon System (155mm); NBC Detection, Protection, and Decontamination; Unmanned Aerial Vehicles and Payload; AirLand Battle Management; Precision Deep Attack; Propulsion 21; Robotics Exploitation; and Very Intelligent Surveillance and Target Acquisition-Combat Information Processor. All of these demonstrations will enhance our capability to offset adverse numerical advantages of potential adversaries, enhance personnel effectiveness, and reduce combat casualties.

The Army technology base contributes to near term readiness and modernization in two ways. First it enhances currently fielded equipment by product improves. Such enhancement also includes application of technologies which, for example, improve training methods, immunize against diseases, or devise better construction capabilities. It secondly contributes to concepts or materiel which revolutionizes equipment and the way we will fight. It thus is a balance between the push of meeting requirements, and the pull of technology which has, and will continue to revolutionize warfare.

STRATEGIC DEFENSE

Since the 23 March 1983 speech by the President in which he announced the goal of eliminating the threat posed by ballistic missiles, a program called the Strategic Defense Initiative (SDI) has been established. The SDI, under the centralized management of the Strategic Defense Initiative Organization (SDIO), Office of the Secretary of Defense, is charged with pursuing technologies for defense against ballistic missiles. Emphasis in the program is being given to nonnuclear weapons for defense. The funds for this critical research program are controlled by SDIO and allocated to the Services for execution on a task basis. The Army portion of the SDI has been in being for more than 25 years and received renewed interest and direction with the formation of the US Army Strategic Defense Command (USASDC) on 1 July 1985. The Commanding General, USASDC, acts as the single point of contact in the Army for SDI matters.

The Army strategic defense program has been conducting R&D aimed at increasing the capabilities and effectiveness of defensive systems for over 25 years. Because of these efforts, the Army has established a highly experienced Ballistic Missile Defense (BMD) organization with an extensive technical data base. The Army is therefore uniquely capable to support the Strategic Defense Initiative through early demonstrations of defense capabilities.

After the Congressionally directed termination of the Army developed BMD SAFEGUARD system in 1975, the US has not had a deployed BMD system. However, a continuing R&D program in BMD technology verification and functional experiments has evolved. It promises new technologies and refined system concepts to provide reduced risk and technically advanced options for consideration for future full-scale development. The potential for highly effective defensive systems has never been greater. New systems concepts possess potential for countering attacking ballistic missiles in all phases of their trajectories. Progress has been dramatic in expanding and advancing the technology base from which these future BMD systems will evolve. As a result, the program is in a position to make substantial contributions to the Strategic Defense Initiative technology efforts.

Major program thrusts are aimed at demonstrating system and subsystem concepts and developing the mature technologies necessary to support them. Significant effort will be put into defense definition, experiments of aircraft mounted optical sensor adjuncts, terminal imaging radar, advanced radar discrimination, and nonnuclear kill interceptors. Nonnuclear Kill (NNK) mechanisms both within the atmosphere (Endoatmospheric) and outside the earth's atmosphere (Exoatmospheric) are the major thrusts of the program. In addition, experiments will proceed on a terminal defense radar, a Battle Management/Command, Control, Communication (BM/C3) system, and data processor. Advanced technology work, to expand the base from which new systems will evolve, will continue on a broad front, including research on directed energy and kinetic energy weapon technologies, advanced sensors, battle management and data processing facilities.

Systems concepts being examined include endoatmospheric and exoatmospheric defenses. The integration of these into a multitiered defense in depth provides a logical and evolutionary growth path for BMD to a wide range of future options to counter a continued buildup of the Soviet threat in both quantity and quality. These options provide the flexibility required for the various potential BMD missions. For example, a defense in depth could provide protection to critical military and industrial installations and other high value targets. By pursuing a broadly based effort, the BMD program maintains the flexibility to provide defense options for many different applications and thus support the President's goal of eliminating the threat posed by ballistic missiles.

The USASDC was recently named the SDI executive agent for Theater Missile Defense (TMD). As such, USASDC is launching an integrated program whose ultimate goal is development of a more effective tactical missile defense capability for the US and its allies. It will focus on three general areas of research, although it is intended that the dynamics will allow free interaction among all efforts. The areas are: Architecture Studies, Combined Allied Defense Effort (CADE), and Extended Air Defense Operations Center Research (EADOCR).

In Architecture Studies, the objective is to design and evaluate evolutionary architectural (what goes where, how, and when) concepts to provide a realistic defense capability against theater missile threats. The CADE will integrate, test, and evaluate US and Allied candidate systems, subsystems, and components which could be used for the interim TMD capability. And finally, in EADOCR, our goal will be development of a test bed capability to support validation of an integrated BM/C3 architecture for theater defense.

The BMD program also operates the US Army Kwajalein Atoll (USAKA) as a national range. The simultaneous use of USAKA for both strategic offensive and defensive program testing provides a unique opportunity to collect realistic data vital to both efforts. The ability of the BMD program to observe and analyze development and operational ICBM firings allows cost savings in the tens of millions of dollars yearly. Kwajalein is the only range in the free world that can accommodate fullscale ICBM tests and provide sophisticated data collection for the terminal and mid-course portions of the trajectory. The USAKA is a unique national resource, utilized by the Services, NASA and other government agencies.

The Army Strategic Defense Program, through its broadly based R&D efforts, seeks to develop multitiered defense capabilities and conduct early demonstrations of critical defense components. The development of nonnuclear kill systems will continue to receive high priority. The BMD program, by building on the existing infrastructure and emphasizing evolutionary development, is able to accomplish these goals and offer a wide range of options for the defense of the country.

MEDICAL RESEARCH

Together with modern battlefield weapon systems, the soldier must be considered a "System" and, as the operator, is the most vulnerable and critical component in the array of battlefield systems. The Army medical research and development program is geared to address performance degradation factors that could make this system inoperable or cause it to operate at reduced efficiency due to physical, psychological, or disease-related stresses in a variety of climates and hostile environemnts, both at peacetime and during period of hositilities.

Many of the normal, daily hazards to the soldier come from sources such as blast overpressure from artillery, combustion fumes from explosions, and radiation from laser, microwave, and radar systems. Army medical research addresses these environmental and occupational hazards. Research in stresses to the soldier-operator produced by materiel systems, battlefield environments, and natural environmental extremes has resulted in a data base and performance criteria for acute mountain sickness. Significant progress has been made in establishing a toxicological data base on smoke and obscurrants. Human performance in military tracking, target detection and retinal response as a function of laser flash and glare conditions has been characterized. Testing of laser/ballistic eye protection has begun. Advances are also being made to aid the soldier in dealing with natural stresses. These include heat, cold, altitude, sleep deprivation, exhaustion, and the psychological strain of the battlefield.

Our personnel are more likely to become casualties from infectious diseases that have decimated military forces during past wars than from any manmade weapon system. Exploiting high payoff technological opportunities in development of drugs, vaccines, and devices for the diagnosis, prevention and treatment of infectious diseases of military relevance is crucial for success in this area. Monoclonal antibody production, genetic engineering, novel drug delivery systems, immune enhancement and biomicrosensor development are being actively pursued. For example, this strategy is also being applied to develop vaccines against parasitic diseases such as African sleeping sickness and leishmaniasis. Two insect repellant prototypes have transitioned to full-scale development. Phase I safety testing was completed on a nonmalarial antiparasitic drug.

Recent advances in biotechnology are being utilized to speed the process of vaccine and drug development and rapid diagnosis kits for potential Biological Warefare (BW) agents. Recombinant DNA and monoclonal antibody techniques are being used to prepare diagnostic reagent field kits for use in rapid identification of BW agents and natural diseases in the field. Continued studies with the Lassa fever in Africa have proven successful. The Argentine Hemorrhagic fever vaccine has passed phase I testing. A diagnostic probe for rapid identification of Rift Valley fever has been developed.

During periods of hostilities, the soldier may also be incapacitated or perform at reduced efficiency due to the effects of chemical and nuclear weapons. In support of the soldier on the modern battlefield, new techniques in disease prevention, self-treatment, patient management, resuscitation, and decontamination have been and are being developed. A vital signs monitor and an individual soldier resuscitator have transitioned to concept exploration. A critical finding which will be instrumental in developing a second generation nerve agent pretreatment was made. Preliminary safety and efficacy studies of new skin decontamination products have been completed.

Improved treatment of combat casualties requires earlier diagnosis and treatment of shock caused by large volume blood loss. In addition to improved resuscitative fluids, pharmaceuticals that may "buy time" until adequate volume replacement can be effected are under investigation.

Research aimed at reducing mortality and morbidity due to head missile wounds is a high priority. Improved management of burn wounds is sought through improved dressings, skin substitutes, and epithelial growth systems.

Combat medical materiel items being developed include field production of oxygen and medical grade (intravenous) water, a field medical refrigerator, heated patient liner for the transportation of casualties, and a wheeled litter carrier which is now in initial low-rate production.

Research in the area of combat dentistry currently includes the following major efforts: the development of synthetic, biodegradable implant materials to replace missing facial bone segments that will accelerate would healing and simplify final surgial reconstruction; competed advanced development and lightweight hand-held field dental X-ray. The computer-assisted post-mortem identification system will be fielded in late FY 87.

DEEP OPERATIONS

Deep Operations allow us to win the Close Operations

Deep operations are those activities against enemy forces not yet in contact with the forces conducting close operations at the forward line of troops (FLOT). Deep operations will isolate the current close operation from enemy reinforcements so that our qualitative edge in training and equipment can defeat the Soviet's quantitative edge. Deep operations are designed to shape the conditions in which future close operations will be conducted. Deep operations are normally conducted at the corps level of command and above. The activities typical of deep operations include the surveillance and acquisition of enemy targets, the interdiction of these targets, the deception of the enemy as to what our forces actually are doing, actions to counter the command and control systems of the enemy, and the command and control of our own forces.

Currently our forces do not have the full capabilities necessary to execute deep operations to the extent envisioned by AirLand Battle doctrine. We have joint programs with the US Air Force to provide for the majority of the deep operations requirements. We are also developing capabilities on our own which will allow us to better execute deep operations.

Joint Surveillance and Target Acquisition Radar System (JSTARS)

The first requirement in any deep operation is that of surveillance and target acquisition. To accomplish this, the Army and the Air Force have entered full scale development of the Joint Surveillance and Target Acquisition System (JSTARS). The JSTARS is a battle management and target attack control system which will be able to detect, track, classify and assist in attacking both moving and stationary targets beyond the FLOT.

The Air Force is responsible for development of the prime mission equipment consisting of an airborne platform, radar, and data links. Target information will be transmitted through the secure data links mounted on the E8A (militarized Boeing 707) airframe to multiple ground stations. The first flight of the Engineering Development Model airborne platform is scheduled for late FY87.

The Army is responsible for the Ground Station Module (GSM) and Downsized Ground Station Module (DGSM). The GSM/DGSM are tactical data processing and evaluation distribution centers that link the airborne radars to Army C3I nodes at corps and division headquarters. JSTARS will share information with other intelligence and fire support systems.

A limited procurement-urgent production decision for the Army Ground Stations is planned this year (FY87). Development for the full-up GSM and DGSM will continue throughout FY87.

By FY90 the GSM will undergo a total system integration with the Joint STARS Airborne platform, radar and data link.

Upon delivery of the JSTARS equipment requested in this two year budget, the modernization effort will be 43% complete. Procurement of the GSM/DGSMs will continue through FY92. The Joint STARS Airborne Platform procurement will continue through FY98.

Joint Tactical Fusion Program/All Source Analysis System (JTFP/ASAS)

The Joint Tactical Fusion Program (JTFP) is building the Army All Source Analysis System (ASAS) and the Air Force Enemy Situation Correlation Element (ENSCE). The ASAS/ENSCE is an automated system that will analyze, fuze, and report intelligence information from tactical and strategic sensors and other intelligence sources such as JSTARS. It will provide field commanders a near real time, detailed picture of the enemy situation and target nominations to guide employment of maneuver forces and weapon systems in the execution of Air Land Battle doctrine.

The ASAS and the ENSCE will be interoperable, using common hardware and nearly identical software. ASAS and ENSCE system configurations will vary by echelon and unit mission. Hardware modules include: the ASAS/ENSCE Interface Module (AIM) and the Intelligence Data Processor (IDP) module, which process intelligence data; the Forward Sensor Interface and Control (FSIC) module, which relays data from forward, ground based sources to the data processing modules; the Communications Processor and Interface (CPI) module, which interfaces the data processing modules with the area communications system; and Portable ASAS/ENSCE Workstations (PAWS), the user interface with the system. Procurement and fielding of three Limited Capability Configurations (LCC's) — comprised of AIM's, FSIC's, and PAWS — will occur in FY87 and FY89, respectively. Procurement and fielding of full production ASAS/ENSCE systems will begin in FY90 and FY92, respectively. A P3I program will evolve the systems with user identified improvements, additional capabilities, and new technology.

During FY88, design and fabrication of IDP and CPI modules will be completed, automation hardware for the US Army Intelligence Center and School (USAICS) training facility will be procured, the first ASAS/ENSCE software release will be delivered, and the second of two USAFE/PACAF intelligence processing software releases will be delivered to the Air Force.

During FY89 an LCC will be delivered to the USAICS, 2 Armored Division, and 1st Cavalry Division, and an RDTE ASAS and an RDTE ENSCE will be delivered to III Corps and to the Air Force at Hurlburt Field, FL, respectively, the second and third ASAS/ENSCE software releases will be delivered, ASAS/ENSCE DT/OT II will occur, automation hardware for the Life Cycle Software Support Center, Ft. Huachuca, AZ, will be procured, and system operator and maintainer training at USAICS will commence.

Army Tactical Missile System (ATACMS)

Once targets have been identified by JSTARS and the decision to attack them has been made, the modern weapon system for that attack will be the Army Tactical Missile System (ATACMS). The ATACMS will be fired from the Multiple Launch Rocket System (MLRS) launcher; each launcher will carry two ATACMS missiles. To the firing units, ATACMS is just another round of crated ammunition, transported and fired from any MLRS launcher. The ATACMS thus extends the capability of the MLRS launcher and crew at no cost in terms of additional manpower or equipment.

Last year the ATACMS program underwent ASARC and DSARC reviews. Following the review process, a Full Scale Development Fixed Price with Incentive contract was competitively awarded to LTV Aerospace and Defense. The contract calls for a 48-month Full Scale Development effort and includes production options with not to exceed (ceiling) prices for the programmed missile buy.

The system critical design review will be conducted in April 1987. Discussions are underway with a number of our NATO allies concerning cooperative opportunities with respect to ATACMS.

Guardrail

Offensive Electronic Warfare

Countermeasures employed against Soviet command, control and communications systems include interception, location, and jamming of these emitters. One of the key means of slowing Warsaw Pact attacks is to delay timely massing of forces by the disruption of their communications capability. Every unit is tied to the coat of its next higher echelon. When communications are lost, the lower units do not exercise sufficient initiative on their own. For deep operations, the GUARDRAIL, the QUICKLOOK and the QUICKFIX systems perform this task.

Guardrail V is a combination of fixed wing airborne sensor and ground processing facilities which provide interception and location data of enemy communications emitters in near real time. The Guardrail V system uses the RU-21H aircraft; the Improved Guardrail V uses the RC-12D aircraft; and future plans will result in the fielding of a Common Sensor system which will use the RC12K airframe.

Quick Fix is a heliborne communication intercept, direction finding and communications jamming system configured to fit the EH-1H, the EH-1X, and EH-60A helicopters. Quick Fix is organic to the division and gives the division commander the capability to conduct deep electronic warfare.

Quick Look is the corps and division commanders' asset to look deep to locate and identify enemy radar systems. Quick Look airborne electronic equipment is mounted in the RV-1D Mohawk aircraft. The remainder of the Quick Look system is mounted in several surface vehicles.

As you can see, the modernization of our deep operations capability is in progress. We have not procured as much modernized capability as we have for our close operations, but our program is balanced and will acquire the desired equipment if it is supported.

Quick Look II

CLOSE OPERATIONS

Close operations are the primary type of engagements fought by brigades of infantry, armor, field artillery soldiers and other supporting arms, at the Forward Line of Troops (FLOT). These are the front line soldiers, and their job is to close with and destroy the enemy by the application of combat power. In order to accomplish their mission, they must be organized into units, which are well trained, and well led, and have modern equipment that will give them the qualitative edge necessary to fight and win. The combat support and combat service support equipment supporting these soldiers must also be modernized. The following paragraphs will describe the key close battle systems which we are requesting in the FY88/89 budget.

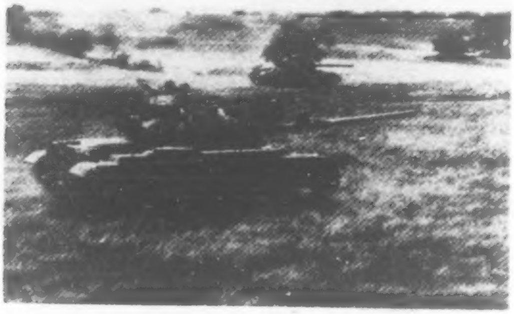
The most fundamental weapons systems of the close battle are the tank, the infantry fighting vehicle, and the attack helicopter. Our forces equipped with these direct fire weapons and organized into combined arms teams are the nucleus of all our modern heavy divisions. We have begun the process of modernizing these systems.

M1 Series Abrams Tank - Main power on the Battlefield

Fire Power and Mobility

Delivery of the M1 tank was completed in June 1986, with thirty two M1 battalion equivalents having been fielded including three Army National Guard battalions. This phase of the M1 series tank program has been highly successful. After five years of fielding, the feedback from tactical commanders and troops has been uniformly positive. The M1 has performed superbly in REFORGER exercises with displays of high speed, tactical maneuverability, and accurate firepower. Its operational readiness rate continues to be at or above the Army's goal of 90 percent.

An equally important step was the start of fielding of the M1A1 tank. The major improvement over the M1 is the incorporation of the more lethal 120mm gun (versus 105mm for the M1). The M1A1 also incorporates automotive and suspension up-grade, armor enhancements, an NBC overpressure system and a microclimatic cooling system which greatly improves the survival chances of the crew in a nuclear radiation, chemical or biological warfare environment. Fielding began at Fort Bliss, Texas, in August of 1986. The first unit equipped with the M1A1, the 3rd Armored Cavalry Regiment, will also conduct the Follow-on Evaluation of the new tank. A total of 535 M1A1 tanks had been delivered as of December 31, 1986. Fielding is scheduled to begin in USAREUR in January 1987. The M1A1 tank system will give our tank fleet greater kill and growth capability to meet an advanced threat.



M60A3

The older M60A3 tank will continue to be an important part of the total Tank fleet into the 1990's. With application of survivability enhancements, the M60A3 tank will improve its capabilities on the battlefield. The Army Nation Guard will rely on the M60A3 as its mainstay well into the future.

120mm Tank (M1A1) Main Gun Ammunition

Production and delivery of 120mm ammunition continues in support of the fielding of the M1A1 tank by battalion sets. Overseas shipments began last year prior to M1A1 deployment. Initial issue quantities as well as sustainment quantities will be in place prior to the tank's fielding. The 120mm munitions are currently comprised of four rounds: The M-829, a Kinetic Energy (KE) round, the M-830, a Chemical Energy (CE) round with a shaped charge warhead, and training counterparts for each.

The Army will continue to buy 120mm ammunition to field and support the M1A1 tank fleet throughout the 1990s.

The Bradley Fighting Vehicle is a full tracked, armored vehicle equipped with TOW anti-tank missiles, the 25mm cannon and 7.62mm coaxial machinegun. The BFV has the cross-country mobility to operate with the M1 Abrams on the combined arms team. Bradleys allow our mechanized forces to maneuver and fight during night or day, providing fires while on the move. The Bradley is an essential element of our modernized battlefield capability.

Bradley Fighting Vehicle

FY88 will be the ninth year of production for the Bradley. As of 31 December 1986, 19 battalion size units have received and fielded the BFV, of which two are Army National Guard battalions.

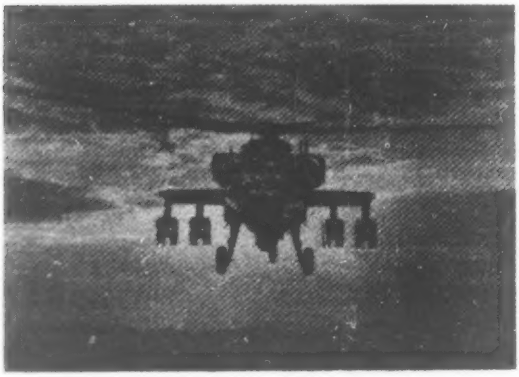
Improvements to the Bradley Fighting Vehicles are being made incrementally. All BFVs being procured in FY87 are in the A1 configuration which incorporates the TOW 2 missile and several interior design modifications.

The vehicles produced with FY87 funds will have modifications derived from lessons learned during survivability testing. Current modifications which appear cost effective are spall liners in the troop compartment, applique armor, limited ammunition restowage, electrical line spall protection, and repositioning of the fire suppression system sensor.

The Army is building an effective attack helicopter fleet to give the close combat team around the clock quick reaction capability, and the firepower to destroy high value targets wherever an enemy is attacking. Our most effective attack helicopter is the AH-64 Apache, complemented by the AH-1S Cobra.

The first operational unit of Apaches was fielded at Ft Hood, Texas, in April 1986. After a very successful battalion level test, the unit was activated in July.

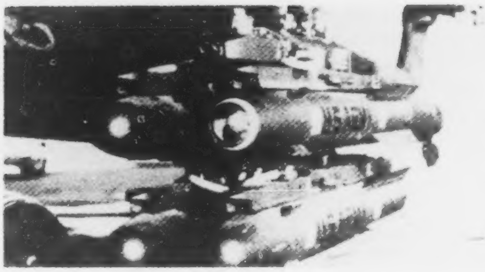
The Apache is armed with laser designated Hellfire (HF) missiles, 30mm cannon, and Hydra-70 rockets. Target Acquisition Designation Sight (TADS) and Pilot Night Vision Sensor (PNVS) provide day/night laser designation and passive infrared night vision for both the pilot and copilot/gunner. The Apache, which is designed to fight worldwide, day or night, and survive, will provide a significant improvement over the current COBRA/TOW (AH-1S) due to its improved performance, survivability, night and adverse weather capability and the greater range and lethality of Hellfire missiles.



AH-64 Apache

Hellfire was already mentioned as the main anti-armor armament of the Apache helicopter. Hellfire is a laser guided missile that has greater lethality, longer standoff range, and shorter time of flight than the TOW missile system. Hellfire is also under consideration as a ground launched weapon. Technical problems with Hellfire production have been solved and both contractors are increasing production at a satisfactory pace. Launcher production is proceeding satisfactorily. The development of a digital auto pilot which will improve system lethality is underway. Electro-optical countermeasures (EOCM) development is scheduled to begin in FY88. The EOCM will harden the laser seeker component.

Other direct fire anti-armor weapons available to soldiers conducting close operations include the TOW, M136 (AT4), and AAWS missiles.

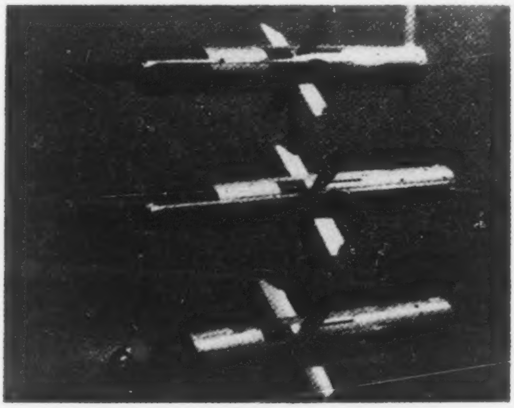


Hellfire

The TOW (Tube-Launched, Optically Tracked, Wire Command-Link Guided) missile has undergone extensive product improvement to keep it effective against recent threat innovations in the area of reactive armor and electro-optical countermeasures. The TOW 2 missile provides a more lethal 6-inch warhead, greater speed and improved guidance.

The TOW 2A has just completed a very successful series of sled and flight tests.

A TOW 2B development program has been initiated, which utilizes a fly-over-shoot-down technical approach. Plans are for production cut-in and fielding of the TOW 2B warhead when development is complete.



TOW 2

Lightweight Multipurpose Weapon System (AT-4) (M136)

The Swedish AT4, type classified as the M136, is a shoulder launched disposable anti-armor system which will be issued as a round of ammunition to individual soldiers. For the Army, the AT-4 supplements the existing inventory of M72 LAWs (Light AntiArmor Weapon).

The round will be produced in Sweden through FY 87. The Army plans to begin transition to onshore production beginning in FY87 with all rounds thereafter being domestically produced.

The Advanced Anti-Tank Weapon System-Medium (AAWS-M) is the replacement for Dragon, which has been in the field since 1975. The AAWS-M program will give the dismounted infantryman a medium anti-tank weapon system portable by one man, and capable of defeating an evolving Soviet armor threat. It will also allow the soldier to operate effectively in battlefield environments filled with obscurants and electro-optical countermeasures. The AAWS-M is the highest priority development program for our light infantry forces.

Advanced Anti-tank Weapon System Medium (AAWS-M)

In August 1986 the Army awarded three contracts for a 27-month "proof of principle" Technology Demonstration. Analysis of data obtained during ongoing technology demonstrations will enable the Army to determined the best technical approach for entry into the Full Scale Development Phase. In parallel with the Technology Demonstration phase, a warhead program will be conducted to evaluate alternative warhead sizes and technologies.

The FY88 program will continue the technology demonstrations, including the conduct of operational assessments, warhead testing and a "shoot off" of the competing technologies. The Request for Proposal for the Full Scale Development will be prepared and released.

The FY89 program will complete the Technology Demonstration phase and initiate Full Scale Development. Additionally, the Army will evaluate contractor proposals and complete award for a 36-month Full Scale Development phase supporting one contractor team. The Army will complete Full Scale Development and initiate production in the early 1990s.

Advanced Anti-tank Weapon System—Heavy (AAWS-H)

The Army plans to initiate the AAWS-H program in FY88 to replace the TOW as the Army's principal Anti-tank Guided Missile (ATGM) system. The effort will continue in FY89.

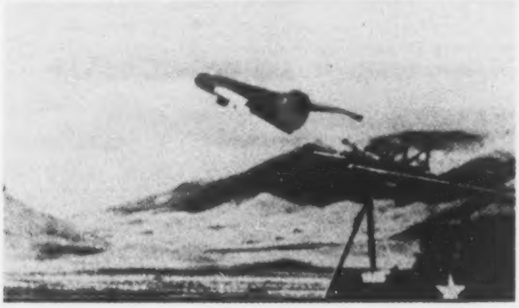
Several technologies will be included in the AAWS-H development. A request for information has been disseminated to industry to seek information in order to determine and assess the state of technology for the potential AAWS-H candidates.

A Milestone Decision Review is planned for FY88. The COEA will continue, requirements documents will be completed, and a request for proposal will be released to industry for technology demonstrations or full scale development, depending on technology maturity.

Aquila Remotely Piloted Vehicle (RPV)

The acquisition of targets beyond direct observation is accomplished though several methods.

Aquila will perform target acquisition, designation and aerial reconnaissance missions in support of the Brigade Commander. The Aquila is a small, propeller driven, pilotless aircraft that can operate in hostile territory without risk to human life. Aquila locates targets, then laser designates targets for destruction by laser seeking artillery or missiles. It also allows adjustment of artillery fires, and performs reconnaissance, damage assessment and other functions. Based on successful completion of Operational Testing (March 1987), production will begin in August 1987.



RPV

Recent Development Testing of Aquila has been highly successful. In January of 1986 the contractor conducted a demonstration of the Aquila system at his own expense to demonstrate progress in resolving technical problems identified by the Army in 1985. The Army then conducted an artillery live fire test in which Aquila scored direct hits with eight out of nine Copperhead laser guided artillery rounds (one munition failed).

During development testing in May 1986 Aquila flew 54 missions demonstrating that it met the key performance requirements of the system. Following the test, Army soldiers "road marched" the equipment 360 miles and scored four out of four direct hits with air launched, laser guided Hellfire missiles.

Procurement of Aquila is currently limited to nine batteries to support the total force.

In FY88, the Army will conduct reliability enhancement efforts for the Aquila system as it moves into production, and continue the engineering development of the night mission payload. Production of the Aquila system will include the equipment necessary to field the first operational battery of Aquila. The Initial Operating Capability (IOC) of Aquila will occur at III Corps in 2nd Quarter, FY91.

The FY89 budget will continue the physical configuration audit of the Aquila system, and the development and operational testing of the night mission payload. Procurement of battery sets will support V and VII Corps in Europe.

Once enemy targets have been acquired, fires must be brought to bear on them. Fire control is automatically accomplished today by the Tactical Fire Direction System (TACFIRE) and in the future by the Advanced Field Artillery Tactical Data System (AFATDS).

The TACFIRE represents first generation technology that provides automated data processing of the fire control process. The system is no longer in production and is not capable of meeting the requirements of the battlefield of the 1990's. TACFIRE's replacement is the Advanced Field Artillery Tactical Data System (AFATDS), and will be discussed in the Battlefield Synchronization section.

Conventional Artillery Indirect Fire Support is provided by cannon and rocket systems. Modernization of these forces is continuing. Current artillery weapon systems are limited in range and lethality by projectiles and rates of fire. Several initiatives are being taken to remedy these shortcomings. A new XM762 electronic time (ET) artillery fuze will be more accurate, easier to set by hand, and capable of being used with inductive howitzer autosetters. To improve lethality at extended ranges, the XM864 base bleed dual purpose improved conventional munition (DPICM) is being developed. Designed to supplement the current M483A1 ADPICM and M549 RAP projectiles, the XM864 will increase DPICM ranges by 60%, and lethality (over the RAP round) by a factor of 6 to 8. Both the XM864 and XM762 programs are technically successful at this juncture, with type classifications scheduled for FY87 and FY 88, respectively.

The FY88 budget will buy 104,000 XM864 projectiles. This will represent the first year of procurement at the production base facilities established at Scranton AAP and Milan AAP.

The Army is requesting in the FY89 budget 146,000 XM762 ET fuzes.

M109A2/A3 Howitzer

The Army continues modifying the M109A2/A3 155mm howitzer fleet to extend its useful life to the 21st Century. Modifications which will provide improved capability and survivability include an improved recoil system and cannon which can fire to a maximum range of 30 kilometers; an on board ballistic computer and gun positioning system; microcooling for increased capability in an NBC environment; and improved ballistic protection. This year fabrication of eleven prototypes will be completed. Testing, including live fire ballistic protection/survivability testing, will continue.

In FY88 we will complete force development testing and experimentation, and initial operational testing and evaluation.

In FY89 we will conclude operational and technical testing, and achieve

IOC in the 4th Quarter FY89 through limited production.

A competitive production contract is to be awarded in 3rd Quarter FY90. Seventeen hundred howitzers are to receive the complete improvement package, while the remaining 700 howitzers will receive NBC and automotive RAM improvements.

Copperhead is a 155mm laser guided artillery projectile designed to attack high value (stationary and moving) hard point targets with a high probably of achieving first round kills. It can be cannon launched from any 155mm cannon in the inventory out to a range of 16 kilometers. Copperhead has been fielded in Korea, Europe and CONUS, and additional procurement is planned between FY88 and FY92 to satisfy theater inventory objectives.

A Product Improvement Program (PIP) has been initiated to enhance performance (lethality and countermeasures) and reduce cost by about 10%. We have evaluated the feasibility of establishing a second source for production of Copperhead, thus providing an alternate mobilization producer. We plan to introduce competition in future buys.

The demonstrated reliability of Copperhead has steadily risen to approximately 84 percent.

Copperhead

The FAASV is a tracked, self propelled, armored ammunition carrier. Last year the FAASV was Type Classified Standard as the M992 (155mm variant) and the M1050 (8-inch variant). Procurement with FY88 funds will be sufficient to complete fielding of the 155mm variant of FAASV to forward deployed artillery forces in Korea and Europe. That will meet a critical requirement since the currently fielded M548 ammunition resupply vehicles are unarmored and lacking in survivability features.

In FY88 the Army is procuring 65 FAASVs for fielding in Europe.

The FY88 procurement terminates production, with final deliveries in 1989. Total procurement quantity is 692 155mm variants.

Field Artillery Ammunition Support Vehicle (FAASV)

Light Howitzer M119

The British Light Gun M119 fulfills the Light Infantry Division requirement for an extended range, lightweight 105mm howitzer. The M119 is towable behind the HMMWV and air transportable by the Black Hawk helicopter. The M119 is initially produced in the UK in order to achieve early fielding to the 7th Infantry Division (FY88). Subsequent procurement will be through coproduction, followed by US production. The M119 can fire existing US standard 105mm projectiles to a range of 14.3 kilometers (km) and has the potential to fire rocket assisted projectiles (RAP) to a range of 19.5 kms versus the 11.5km and 14.5km (RAP) range of the M102 which it replaces.

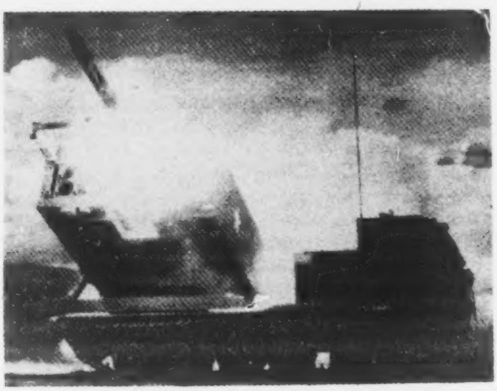
The M119 is scheduled for conditional fielding in first quarter FY88 with an interim logistics package. Organic integrated logistics support will be available in first quarter FY89.

The FY88 budget will procure 113 howitzers and complete US facilitization. We are also requesting 15,000 rounds of XM913 Rocket Assisted Projecticle (RAP), the new extended range RAP cartridge designed for use in the M119 howitzer.

In FY89 the Army plans to procure 103 howitzers and 24,000 rounds of XM913 RAP.

Procurement of the M119 continues thru 1992 to achieve the procurement objective of 548 howitzers.

The Multiple Launch Rocket System (MLRS) is an all weather, indirect fire, free flight, multiple launched rocket system that can deliver overwhelming firepower against enemy artillery, air defense, and other light materiel and personnel targets, such as assembly areas and command posts. It can fire up to 12 13-foot rockets with dual purpose improved conventional munitions to ranges over 30 kilometers in less than one minute. The MLRS includes a tracked, self propelled launcher loader, disposable launch pod containers and rockets. The MLRS met its Initial Operational Capability (IOC) in 1983 and is presently fielding batteries throughout the world. Growth potential for MLRS exists for a terminal guidance warhead, a sense and destroy armor (SADARM) warhead, and a Binary Chemical



Multiple Launch Rocket System (MLRS)

warhead. The MLRS is being produced in partnership with France, Germany, Italy and the UK, who are to jointly produce the system in Europe.

Twenty one MLRS batteries have now been fielded and three POMCUS batteries are in place.

The FY88 and FY89 budget will continue to fund rockets. Two additional MLRS batteries of launchers in FY88 and four batteries of launchers in FY89 are scheduled for procurement.

The Army will continue to produce launchers and rockets to support Army requirements. In addition, the USMC has expressed an interest in the MLRS.

MLRS Terminal Guidance Warhead (TGW)

The MLRS includes a preplanned improvement for a terminal guidance warhead (TGW) with anit-armor capability. The development contract for the TGW was awarded in November 1984 as a codevelopment effort of US (40%),France (20%), United Kingdom (20%), and Germany (20%). This joint venture with our European partners will help meet an urgent need to defeat targets such as armored vehicles before they are committed into the close battle. The MLRS-TGW will be able to attack moving and stationary armored vehicles and equipment from above, using highly accurate and lethal submunitions dispensed from a MLRS rocket. The TGW is now in the Component Demonstration substage.

Last year the design, development, analysis, test and evaluation of critical components and subsystems was initiated. Preliminary efforts are being made to integrate the TGW into the basic MLRS.

There is one remaining area of importance in the close operations area, the direct and indirect fire of the infantry.

The Squad Automatic Weapon SAW is a lightweight, one-man portable 5.56mm automatic weapon that can deliver a large volume of fire to a maximum effective range of 800 meters. The SAW was initially fielded to the 82d Airborne Division in 1984. An FY85 solicitation for a multi-year contract was cancelled in order to design and test user required modifications. These modifications were tested and adopted last year. The Army expects to awards a multi-year contact for production of the SAW in 1987.

The FY88 budget will procure SAWs which will equip selected light infantry units.

In FY89 the Army plans to buy 5670 SAWs.

Squad Automatic Weapon (SAW)

MK-19 Grenade Machinegun

The MK-19 MOD-3 is a self powered, air vehicles cooled, blow back, 40mm automatic grenade launcher capable of cyclic rate of fire of 325-375 rounds per minute. It provides more accurate, longer range fire power against enemy personnel and lighly armored vehicles than the weapons which it replaces, M2 machine guns and vehicular mounted M60 machine guns. It can engage point targets up to 1600 meters and provide area suppressive fires out to 2200 meters.

The Navy is currently the Executive Agent for this program with the Army expected to assume responsibility in FY88. The weapon will be mounted on a variety of vehicles and can be ground mounted.

The FY88 budget will purchase 1408 MK19s, while 1326 MK19s are programmed for FY89.

120 Mortar

The 120mm will be the battalion level mortar for heavy forces. It was chosen as an off the shelf replacement for the current 4.2 inch mortar primarily because the 120mm offers greater range, lethality, and ammunition growth potential. A competitive shoot-off by three off shore producers was conducted in 1986. Selection of the winning producer was sheduled for March, 1987; however, none of the offered systems met all of the minimum requirements. The competitors will be required to correct deficiencies, and be retested for requirements not met, prior to source selection.

A US production base for both weapons and ammunition will be initiated. Off-shore procurement will be limited to test quantities for type classification plus 63 systems, and ammunition, to equip the 9th Infantry Division.

Integral to the 120mm effort is an ammunition development program that provides enhanced lethality and improved range and accuracy for the high explosive, smoke, illumination, and training rounds. If possible, the enhanced ammunition program will be a further improvement of existing ammunition candidates currently under evaluation.

The Army plan is to procure 332 weapons with FY88 funding, and 350 in FY89.

The Army's procurement objective is 2,606 weapons with the last year of procurement currently scheduled for FY93.

REAR OPERATIONS

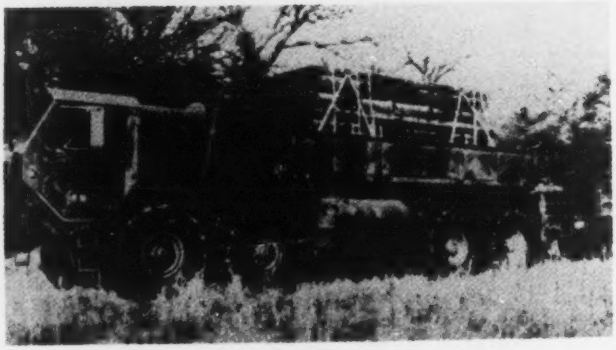
Providing freedom of action for close operations

Rear operations are all the activities rearward of elements in contact. Rear operations are designed to assure freedom of maneuver and continuity of operations for the remainder of the force. The activities normally considered in rear operations include assembly, movement, and positioning of reserves and long range fire support; movement, stockpiling, and distribution of war materiel; maintenance and field services; establishment and maintenance of lines of communication; traffic regulation and control; maintenance of civil order; and the defense against air, ground, and missile attack. Our modernization of systems required to conduct these activities is progressing. We have been fielding the UH-60 Black Hawk and CH-47 utility helicopters. Heavy ground transport is being performed with the 10 Ton HEMTT. We are also proceeding with our efforts on the planned Families of Medium and Heavy Vehicles. The modernization of our air defense and anti-missile defense has begun. The highlights of these systems follow.

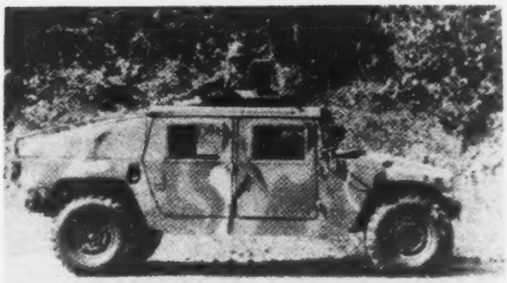
Tactical Transportation

As you review these systems, keep in mind that the employment of many of them will require that they operate in close and deep operations. Under normal conditions, these systems are usually based in the rear area. For example, utility transport systems such as the UH-60 Black Hawk, the CH-47 Chinok, the utility version of the Light Helicopter Family, and tactical wheeled transporters all enter the close operations area to deliver the supplies and personnel required to sustain these operations.

5-Ton Truck



10-Ton HEMTT



HMMWV

Tactical Wheel Vehicles

Tactical transportation needs, integral to all combat operations, have undergone dynamic changes in the past few years. Our mobility has been greatly improved both in the air and on the ground. The main deficiency today is in the area of tactical wheeled vehicles.

Although the production and fielding of vehicles continue, the tactical wheeled vehicle fleet remains critically short of meeting requirements, especially in the medium vehicle fleet, which is the workhorse of the Army's unit tactical mobility mission. This fleet is significantly short 5-ton trucks and is also comprised in great part of 2½ ton trucks reflecting 1950's design and technology. To partially remedy this, a new 5-year multiyear contract for approximately 15,000 5-ton trucks was awarded in May, 1986. The FY88 and FY89 budget will continue funding this contract and thereby assure continued production and fielding of the current 5-ton truck. We will also initiate new programs to begin to modernize the medium fleet and to introduce more efficient systems into the heavy truck fleet.

We will initiate test and evaluation programs in FY88 for a Family of Medium Tactical Vehicles (FMTV) and also a Family of Heavy Tactical Vehicles (FHTV) which will incorporate the palletized loading system (PLS) concept. These programs will be of the Non-Developmental Item type

UH60 Black Hawk

Black Hawks in action

rather than long development programs. Each program will include comptetitive award of contracts to three contractors to provide prototype vehicles. These vehicles will be evaluated to determine whether they meet the stated requirements and to facilitate the source selection process. The initial FHTV contract will be awarded competitively in FY90. Initial production of the FMTV is planned for FY91.

Our 10-ton HEMITT program continues with the purchase of vehicles to support the fielding of such key force modernization systems as Apache, PATRIOT and MLRS. Future requirements in this vehicle class are being evaluated as part of the definiton of the FHTV-PLS program.

In Fy88, a new 5-year multiyear contract for the High Mobility Multupurpose wheeled Vehicle (HMMWV) will be awarded to assure continued fielding of this important addition to our light fleet. Procurement of the Small Unit Support Vehicle (SUSV) will continue for the 6th ID(L) in Alaska. Motorcycles for use in light divisions will be procured.

The Black Hawk is a highly maneuverable helicopter that can carry up to 14 combat equipped troops or an equal cargo load in all expected geographical environments. The Black Hawk has been successfully employed under demanding tactical conditions in field exercises and was used extensively in Grenada. Its enhanced survivability plus significant technological reliability, availability and maintainability (RAM) improvements gives it a staying power before achieved in a helicopter.

UH-60 Black Hawk

The Black Hawk was the Army's first major multiyear procurement and is completing its second airframe multiyear procurement contract (FY85-FY87).

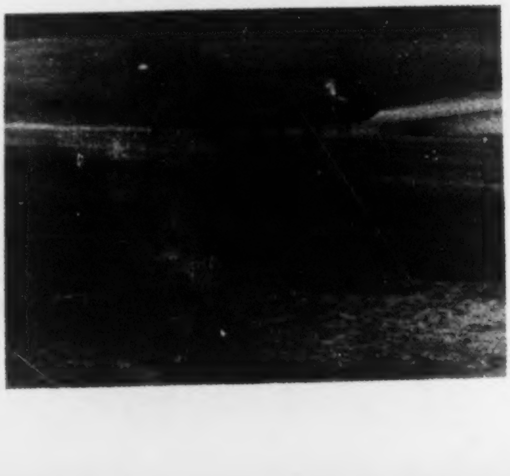
The FY88 budget will procure 61 UH-60s (four companies) and begins procurements of Hellfire missile system missile kits. It also completes field retrofit of the wire strike protection system and begins production of solid state flight data recorders. It continues fielding of 230-gallon crash worthy external fuel tanks.

In FY89 the budget request will procure 72 UH-60s (approximately 5 companies) and continues procurement of Hellfire, 230-and-450 gallon external fuel tanks, auxiliary heaters, and medevac kits.

The CH-47 CHINOOK is the Army's medium lift helicopter. It is being modernized to the D model configuration to extend the service life into the period 2004-2010.

The program entered its seventh year of production in October 1986 on schedule and there are no known deviations anticipated. By the end of 1986, 140 CH-47Ds were in the hands of troops.

Fielding to FORSCOM units continues with Ft. Lewis in progress by year's end. The total number of CH-47Ds to be modernized is 436.



CH-47D

The Army program will modernize 48 aircraft (3 companies) in both FY88 and FY89. FY89 completes the current multiyear contract. Plans are underway to pursue either a follow-on multiyear contract (FY90-92) or single year procurements to complete the modernization efforts for the CH-47 fleet.

Light Helicopter Family (LHX)

The Army's Light Helicopter Fleet (OH-58, AH1, and UH-1) is approaching obsolescence and will be unable to meet the growing Soviet threat of the 1990's and beyond. The current fleet is becoming increasingly difficult to maintain and expensive to operate. The Light Helicopter Experimental (LHX) will provide a highly reliable, easily maintained weapons system with the lethality and enhanced survivability necessary for employment on the battlefield of the future. Improvements in vision enhancement equipment, navigation systems, flight instruments, and system automation will expand the war fighting capability of Army aviation into the hours of darkness and adverse weather.

A technology development program, Advanced Rotorcraft Technology Integration (ARTI), was initiated in 1985 to reduce the technical risk of a new aircraft program. Following successful accomplishment of all ARTI tasks, additional efforts are being undertaken during FY87 to conduct further cockpit/mission simulation, wind tunnel testing, and mission equipment package design and demonstrations. All efforts are designed to ensure that the LHX will enter a competitive full scale development phase in FY88 with no high risk technology areas.

Full Scale Development of a LHX compatible, 1200 shaft horsepower, nonregenerative, free power turbine, turboshaft engine is continuing on schedule, on cost, and exceeding performance estimates. The T-800 engine employs advanced engine technology to obtain a high power to weight ratio with low specific fuel consumption.

The initiation of Full Scale Development during FY88 will result in initial qualification of LHX equipped Army aviation units in 1995. The units will enhance the conventional war fighting capability of the Army while remaining within constrained force structure and funding projections.

M9, Armored Combat Earthmover (ACE)

The M9 Armored Combat Earthmover (ACE) meets the combat arms requirement for a highly mobile, armored earth moving vehicle that can dig, doze, haul and scrape. It is fast enough (30 mph) to keep pace with fighting systems on the modern battlefield while providing mobility, countermobility and survivability support to the combined arms force. It offers the operator protection from small arms fire, artillery fragmentation, and NBC agents.

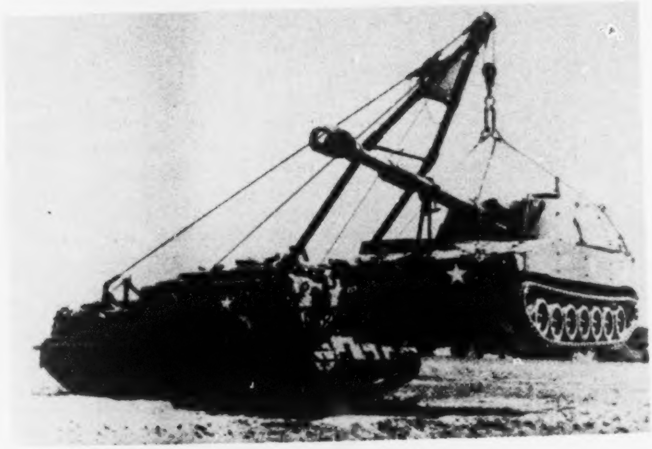
In July 1986 a firm fixed price contract with five years of priced options was awarded to BMY of York, PA. The competitive nature of the procurement resulted in a 40-percent program cost savings over previous Army projections. Award of the first option was made in November 1986. In April 1986 seven Low Rate Initial Production ACEs were fielded to the first unit equipped, the 7th Infantry Division (Light). The performance of the ACE in support of division certification was outstanding and its capabilities were proven in a light division. TRADOC fielding to the training base took place in September 1986.

The FY88 budget procures vehicles to fill out the training base, five divisional combat engineer battalions and two armored cavalry regiments.

The FY89 budget will procure vehicles to fill four divisions, an ARNG round out unit and POMCUS requirements.

ACE

M88A1 Recovery Vehicle Improvement Program



Total procurement of the ACE is scheduled to be 581 vehicles through 1992.

Under certain conditions the current M88A1 recovery vehicles are incapable of safely towing M1 and M1A1 main battle tanks. An improvement program for the M88A1 will incorporate a higher horsepower engine, more weight, improved winch and boom, and better armor protection.

The FY88 budget plan will conduct system test and evaluation and related engineering during this period. Half way through DT/OT, an advance procurement decision will be made.

In FY 89 we will procure 80 M88A1E1s for Low Rate Initial Production.

Procurement of the M88A1E1s will continue through FY94 with the M88A1E1 being procured for 121 M1/M1A1 battalion sets, POMCUS, and PWRMS.

SURVIVABILITY FROM AIR ATTACKS

Our Air Defense systems must protect all elements including troop formations, depots, lines of communication, air bases, key command and control facilities, and other vital assets. A comprehensive air defense umbrella for these assets is needed at all ranges, altitudes, and type of operations. For the low altitude threat to the division we are developing and fielding the Forward Area Air Defense System. Medium and high altitude attacks are countered by the PATRIOT and improved Hawk systems.

Forward Area Air Defense System (FAADS)

The Forward Area Air Defense System (FAADS) was defined by a special study group convened after the termination of the SGT YORK Division Air Defense Gun system.

The lessons learned from the SGT YORK experience proved that one system alone, or even multiple weapons acting independently, cannot defeat the evolving Soviet air threat. On-going Army programs are being combined with new technology to integrate weapons, sensors, and command, control and intelligence architecture as a system. This optimized system of systems will counter the entire spectrum of the air threat to the forward area through the 1990's and beyond. The FAADS concept is designed to provide total coverage in the division area and permit the enemy no preferred attack options. The strategy relies heavily on non-developmental items and preplanned product improvements (P3I) to rapidly overcome our current air defense deficiencies and keep pace with the advancing threat. The five components of FAADS are the Line of Sight—Forward—Heavy weapon, the Non Line of Sight weapon, the Line of Sight—Rear Pedestal Mounted Stinger weapon, enhancements to Combined Arms weapons (tank gun munitions, Bradley Fighting Vehicle, air-to-air Stinger) and the FAADS Command, Control and Intelligence component.

FAADS Line of sight-forward-heavy (LOS-F-H)

The line of sight-forward-heavy (LOS-F-H) weapon is a non-developmental item that will be fielded on a tracked vehicle with Army heavy divisions to effectively engage the helicopter and fixed wing threat to the maneuver forces. The LOS-F-H Air Defense weapon will kill and suppress enemy aircraft and exposed helicopters before they can engage friendly forces. It will be effective against helicopters hovering in clutter and operate at night as the threat gains this capability.

FAADS Non Line of Sight (NLOS) Air Defense Weapon

The non line of sight (NLOS) weapon will effectively engage hovering or slow moving helicopters at extended ranges. Heavy and light divisions will be able to attack helicopters to include the HAVOC class that are standing off beyond the range of forward forces or masked by terrain.

Test flights of Fiber Optic Guided Missile (FOG-M) have demonstrated the ability to fire a small missile from a HMMWV and kill flying helicopters up to 10km from the fire unit.

With FY88 funds FOG-M user testing will be conducted and a contract awarded to two contractor teams for a 14-month technology transfer phase. The growth program will continue to develop a FOG-M missile with extended range and night fighting capability.

In FY89 a contract for long lead items will be awarded with the limited production option exercised in the first quarter, FY90. The growth program will continue. The first unit equipped will be in FY91.

Pedestal Mounted Stinger (PMS)

The Pedestal Mounted Stinger (PMS) weapon, the Line of Sight-Rear component of the FAADS, will be a lightweight, highly mobile surface to air missile system operated by a two man crew for defense against fixed wing aircraft and helicopters at low altitudes, in both day and night operations. It will be employed primarily in the division rear battle area. Twenty systems were procured in FY87 for selection of a producer. The PMS is being procured as a non-developmental item (NDI) with contract award expected in May of 1987. The PMS program will be reviewed in April 1987 to assess the candidate evaluation test results and a decision made on entering initial production. Initial deliveries are schedule to begin in FY88.

In FY88 the Army plans to fund 39 PMS systems. Following completion of initial production verification testing of PMS, FY89 funding will initiate full scale production of 100 PMS systems. Procurement of PMS will continue thru FY95 with at least 1207 systems being procured.

Combined Arms Initiatives

Various combined arms initiatives are being pursued for direct contribution to the air defense battle. These include air-to-air Stingers on the OH-58 C/D initially and then potentially on a variety of platforms; improved air defense sights for the Bradley Fighting Vehicle; other possible improvements to the sight, fire control and gun rate of fire of the Bradley; and improved tank ammunition capable of both helicopter and tank engagements. These programs are funded under their own lines but managed and coordinated with the rest of the FAADS program.

The last component of the FAAD system is the Command, Control and Intelligence (FAAD C2I) system, which will be discussed later.

Stinger/Stinger Passive Optical Seeker Technique (POST) and Reprogrammable Microprocessor (RMP)

Stinger is a manportable, shoulder fired, passive, infrared homing guided missile system in a disposable launch tube with a reusable grip stock and identification, friend, or foe, (IFF) unit. It provides company size combat units protection against air attack. Basic Stinger, which entered formal Engineering Development in June 1972, deliveries were completed in January, 1987. Initial deliveries of Stinger-POST, which improves performance in an infrared countermeasures environment, began on schedule in September 1986.

Development of a reprogrammable microprocessor (RMP) is underway. The RMP will provide a capability to facilitate future change to the seeker software to counter IR countermeasures. Three successful firings of the RMP have been conducted. RMP will be deployed to USAREUR in 1988.

Stinger

The FY88 request will fund 4,200 Stinger RMP missiles. Included is the required ground training support equipment. The FY89 budget buys 5,000 Stinger RMP missiles including the required ground training support equipment. Procurement of Stinger RMP will continue through FY93.

Chaparral

Chaparral is the Army's short range air defense missile system. It is effective against all types of aircraft at low altitudes and provides protection for forward deployed divisions and corps and theater rear areas.

An ongoing product improvement engagement capability. To keep Chaparral current against the improved counter-measure threat, the Rosette Scan Seeker (RSS) guidance system was developed.

Other new developments include FLIR optical improvement, and a collective Nuclear, Biological and Chemical Protection system. The Army National Guard will be equipped with Chaparral fire units for four battalions by FY89.

The FY88 funds will buy 122 new missiles and retrofit additional RSS seekers onto older missiles. This funding will be the first full year of production of the RSS missiles and begins the build up of the production rate. Modification to 524 rocket motors will be accomplished to make them smokeless.

The FY89 request will procure 368 RSS missiles and continue the retrofit program. The smokeless rocket motor modification program for Chaparral missiles will be completed in FY89.

Higher Altitude Air Defense (HAWK)

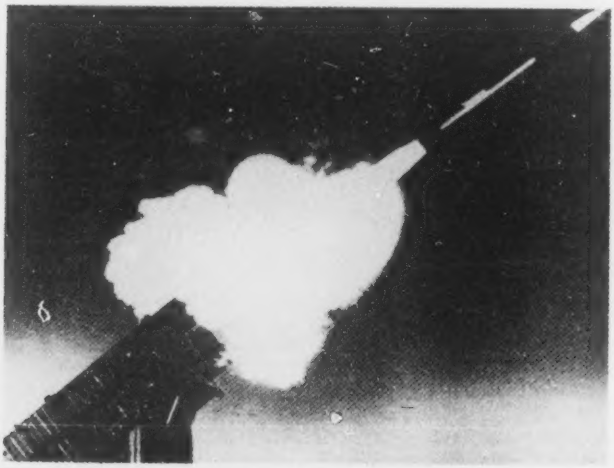
HAWK is undergoing its third major product improvement which will keep it effective into the 1990's as the Army's medium range surface to air missile system. HAWK provides vital air defense against low to medium altitude air attack of air bases, critical logistics installations, and corps air defense priorities. The FY88 request will continue procurement of Phase III kits which will increase firepower and improve mobility and operator training as well as provide chemical collective protection equipment. The systems' field maintenance equipment (FME) is also being upgraded to further reduce manpower needs and improve operational availability.

PATRIOT

High altitude threats are attacked with the PATRIOT missile system. PATRIOT is the most sophisticated air defense system in the free world, capable of operating in an electronic countermeasures environment against high speed aircraft at all altitudes. The fourth European PATRIOT Battalion was activated in May and deployed in December.

An aggressive Product Improvement Program is underway to increase PATRIOT's capability and provide the foundation for PATRIOT's Anti-Tactical Missile (ATM) capabilities. A September 1986 test at the White Sands Missile Range demonstrated PATRIOT ATM capabilities when a production PATRIOT missile intercepted a Lance surface-to-surface tactical ballistic missile. The PATRIOT system used modified software to control the radar and missile to intercept.

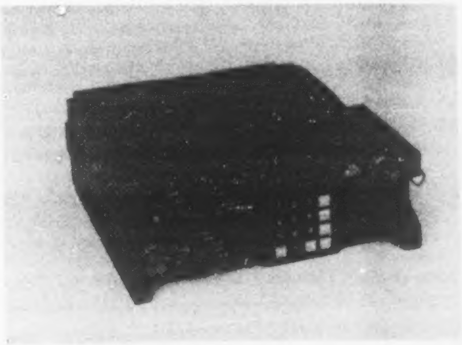
The FY88 budget will procure 12 fire units and 715 missiles. The FY88 funding will be the second year of the five year multiyear procurement.



The FY88 RDT&E budget will continue PATRIOT improvement programs, especially PATRIOT missile upgrades needed to provide ATM improvements. In FY89 we have budgeted for 9 fire units and 815 missiles.

BATTLE FIELD COMMUNICATIONS

A dynamic battlefield coupled with the uncertainties of war demand a flexible command and control system to support highly adaptable multifaceted organizations. The function of a command and control system is to permit coordination and unity of effort. The Army Command and Control System (ACCS) is designed to improve synchronization of combat forces through efficient information management in the five battlefield functional areas of Maneuver Control, Fire Support, Intelligence/Electronic Warfare, Combat Service Support, and Air Defense. All five battlefield functional areas will have an ACCS system that will be networked for critical information exchange. Information entering this network will be distributed to commanders and their staffs in near real time using voice, data, and record traffic communications.



ACCS

The Single Channel Ground and Airborne Radio System (SINCGARS) will provide the voice communications capability to the ACCS network. The SINCGARS is the Army's next generation of lightweight, securable VHF-FM combat net radios. They will be capable of operating in voice and data modes in an electronically hostile environment by using an antijam technique known as frequency hopping. The SINCGARS radios are configured in manpack, vehicular, and airborne modes. The modular construction approach permits the replacement of five currently fielded radios and thus reduces the maintenance burden.

Single Channel Ground and Airborne Radio System (SINCGARS)

Procurement of SINCGARS will continue through 1998 with a total quantity of 277,703 radios being procured.

The Army Data Distribution System (ADDS)

Tactical data distribution in the ACCS network is performed by the Army Data Distribution System (ADDS). The ADDS will give combat commanders the capability of meeting near real time data communications and position location reporting requirements. The ADDS consists of two systems, the Enhanced Position Location Reporting System (EPLRS), a joint Army/Marine program, and the Joint Tactical Information Distribution System (JTIDS), a tri-service program. The JTIDS, as a component of the ADDS, will be employed by the Army Air Defense users.

The EPLRS portion of the ADDS program will be reviewed in April 1987 to assess its readiness to enter a Low Rate Initial Production. Emerging test information from the basic PLRS and EPLRS will be used in making this assessment. Plans are for all PLRS hardware to be modified to the EPLRS configuration by 1990.

The first priority for fielding EPLRS and JTIDS terminals is to support FAAD C2I.

Following completion of comprehensive testing of the ADDS, FY89 funding will initiate full scale production, including production of the JTIDS Class 2M terminal.

Mobile Subscriber Equipment

The Mobile Subscriber Equipment (MSE) is a secure, automatic digital area communications system which will provide mobile and stationary users at Corps and division level with voice, data and facsimile capability. The underlying concept of MSE is to better support AirLand Battle area communications provided at Corps and below. MSE will be more mobile, less manpower intensive and more survivable than existing area communications facilities. The force structure identified in the current MSE contract will be totally equipped by 1993 with equipment that provides multiple communications nodes and network features which automatically bypass and reroute communications around damaged or jammed nodes. It will greatly facilitate operations through its modular signal organization structure, mobility and quick set up/displacement capability. The system is interoperable with TRI-TAC, combat net radio, commercial telephone systems and NATO communications networks.

The MSE program is progressing according to the planned acquisition strategy. The basic MSE contract and the 1st option, awarded last year, will provide one Division Set for the 1st Cavalry Division at Ft Hood, Texas, a Corps Area Signal Support Company and the first of two training base sets.

The FY87 program of $903.7M for option 2 is scheduled for award not later than March 1987. This will procure MSE for five Division Signal battalions, five Corps Signal battalions and the second training set.

In FY88 we plan to procure five more division Signal battalion sets with associated MSE division equipment plus seven corps MSE Signal battalion sets. During the 4th quarter of FY88 the MSE Follow on Test and Evaluation will be conducted at Ft Hood, TX.

Funding in FY89 will procure eight division Signal battalion sets with associated division MSE equipment and four corps Signal battalion sets.

Advanced Field Artillery Tactical Data System (AFATDS)

The command and control of the Fire Support functional area will be accomplished by the Advanced Field Artillery Tactical Data System (AFATDS). The role provided by the AFATDS will be critical to implementation of AirLand Battle doctrine. The AFATDS will provide fully automated support for the planning, coordination, and execution of close support, counterfire, interdiction and suppression of enemy fires. It will meet fire support requirements of the Army Command and Control System (ACCS) during the 1990-2010 timeframe. Compatibility will be provided with all existing and planned US and Allied Field Artillery Systems and sensors.

The AFATDS will also correct the fire control and distribution deficiencies of the current TACFIRE system with no increase in personnel requirements, with greatly reduced size, and minimized training burden.

The fielding objective of the AFTADS program is to field five corps in five years.

The FY88 plan is to develop and procure the software and hardware for an accelerated fielding beginning in FY90. In FY89 we will continue the accelerated program.

Battery Computer System (BCS)

The Battery Computer System (BCS) is a compact, tactical computer system at field artillery battery level. The BCS is composed of a Battery Computer Unit (BCU), Power Distribution Unit (PDU) and Gun Display Unit (GDU). Firing data is transmitted to the weapon automatically via digital links (wire or radio) and is displayed on the GDU at the weapon. The BCS can operate autonomously, with the TACFIRE system, or with the AFATDS/ACCS architecture. An expanded memory for the BCS, which will be fielded by the end of FY88, will permit computation of data for smart munitions and the MLRS.

Last year the Army completed fielding to the active force and began fielding to the Reserve Components. FY87 is the last year of procurement while fielding is to be completed in FY89. When fielding is completed there will be 1109 deployed.

The Army will begin evaluating the need for a new contract that procures a follow-on BCS in the 1990 timeframe.

Maneuver Control System (MCS)

Controlling the movements of our forces is accomplished with the Maneuver Control System (MCS). The MCS provides computer aided decision support to tactical commanders and operations personnel at corps through battalion levels. Important battlefield information can be collected and reviewed, with subsequent battle plans, orders, estimates and tactical reports being produced and distributed rapidly. The MCS consists of fully militarized and NDI items. Production of the militarized MCS computers is in its fourth year and the software evolution continues based on field user feedback and evaluation in Europe. The NDI portion of the MCS was type classified and is in production. The program is successful and has substantial momentum. The fully militarized device with version 9 in the Ada software language is undergoing follow on evaluation (FOE I). The NDI equipment underwent a successful Operational Assessment during July 1986 at Fort Carson.

The FY88 program will complete the NDI portion of the MCS. The FY89 request will provide for small quantities of ACCS common hardware for use in the MCS development programs for eventual integration into the Army. The current MCS system will be eventually transferred to the Reserve Components to be used for enhanced training and standardization in operations procedures.

The Combat Support and Combat Service Support requirements for

Tactical Army Combat Service Support Computer Systems (TACCS)

command, control, communications, and intelligence are supplied by the Tactical Army Combat Service Support Computer Systems (TACCS). The TACCS is a ruggedized, transportable, user friendly non-development item system that will provide retrieval, editing, printing and data transmission capability at various levels of command down to battalion level. Additionally, it will replace the punched card machines now being used. The TACCS will improve the accuracy, timeliness and transmission of the administrative and logistical data required to support the Army in the field. The program will support a world wide fielding of the TACCS to both active and reserve components.

In FY88 we will purchase the TACCS for fielding to various CONUS Active, Reserve, and Army National Guard units as well as units in Germany, Puerto Rico, Korea, and Japan. These TACCS fielded will be used to automate the following applications: the Standard Installation/Division Personnel System (SIDPERS), the Standard Army Retail Supply System (SARSS), the Standard Army Maintenance System (SAMS), the DA Movements Management System (DAMMS), the Theater Army Medical Management and Informantion System (TAMMIS), the Tactical Army Financial Interface System (TAFIS), the Standard Property Book System (SPBS), and the Calibration Management Information System (CALMIS).

Included in FY89 procurement will be fielding of the Army COMSEC Commodity Logistics Accounting and Information Management System (ACCLAIMS) and the remaining applications initiated in FY88.

Forward Area Air Defense Command, Control and Intelligence (FAAD C2I)

The Air Defense Artillery command and control in the forward area will be performed by the Forward Area Air Defense Command, Control and Intelligence (FAAD C2I) component of the Forward Area Air Defense System. The FAAD system consists of weapon delivery elements tied together by command, control and intelligence elements which also integrates the FAADS with the supported forces through the ACCS architecture. The FAADS C2I element incorporates a family of sensors and identification equipment (ground and aerial, active and passive) with an automatic data processing and distribution capability. The FAADS C2I will correct serious deficiencies in targeting, air defense operations and force integration. This is achieved through processing and dissemination of aircraft alerting and cueing data from sensors, weapons control orders and other air defense and C2 data.

The systems integration contract for the FAADS C2I design and software development was awarded in FY86. In FY 1988, the non- developmental item ground sensor shoot off, hardware evaluation and source selection is to be completed and a low rate initial production contract will be awarded. The system integration and software development effort will continue. Low Rate Initial Production is planned to support developmental and operational testing in FY90/FY91. System definition for the FAADS aerial sensor which is needed to detect and track low flying or hovering helicopters that are beyond the FLOT and masked by terrain or clutter will continue in FY88. The positive hostile identification effort continues full scale development, integration and testing in FY88 for an FY89 low rate initial production start for selected weapon applications. Development and testing continues for additional weapon and sensor applications.

Commanders within the theater of operations are linked to CONUS and the National Command Authority (NCA) by tactical and strategic satellite communications programs. Tactical satellite programs include the fielding of the AN/TSC-85A and the AN/TSC-93A, multichannel systems, and Ultra High Frequency (UHF) manpack and vehicular satellite terminals. The continuing development of the Single Channel Objective Tactical Terminal (SCOTT) will provide jam resistant and highly survivable long haul capability to commanders in the 1990's.

Single Channel Objective Tactical Terminal (SCOTT)

The Single Channel Objective Tactical Terminal SCOTT is a highly mobile tactical satellite ground terminal that will operate within the Military Strategic and Tactical Relay (MILSTAR) Satellite Communications System. The SCOTT terminal provides up to four secure voice or data communications channels. Within the Army, the SCOTT will be deployed from division through theater levels. A firm fixed price Full Scale Engineering Development contract was awarded in December 1985.

The FY88 program will continue engineering development of the SCOTT and support developmental and operational testing. The FY89 request will provide for continued engineering development, refurbishment of engineering development models and initial procurement of production terminals.

Procurement of the SCOTT terminals will continue through FY95 for fielding to the training base, active corps and divisions and reserve components.

Defense Satellite Communications System (DSCS)

The Department of Defense requires tactical and strategic communications independent of normal terrain limitations to support command and control of its forces. The Defense Satellite Communications System (DSCS) program provides world wide long haul satellite communications capability to meet unique and vital military requirements. The Army portion of this joint program develops and procures ground satellite communications terminals, and network control facilities for deployment worldwide.

Present Army research, development and procurement programs are providing a modern, more survivable and enhanced capability for the DSCS. The FY88 budget request will continue modernization and increase the survivability the DSCS. In FY89 we will continue with the FY86-FY88 programs and initiate the procurement of additional training devices to enhance accomplishment of the Army's tri-service training mission.

FY88/FY89 RDT&E PROGRAMS

PROGRAM ELEMENT NUMBER	ITEM NOMENCLATURE	FY86	FY87	FY88	FY89
	TECHNOLOGY BASE				
61101A	IN-HOUSE LAB INDEPENDENT RESEARCH	23.814	16.840	0.0	0.0
61102A	DEFENSE RESEARCH SCIENCES	142.009	116.973	114.411	117.369
61103A	UNIVERSITY RESEARCH INITIATIVES	84.462	84.030	84.554	80.273
62105A	MATERIALS	14.077	14.891	11.715	13.141
62120A	NUCLEAR WEAPONS EFFECTS/FLUIDICS	24.865	37.126	51.746	42.157
62303A	MISSLE TECHNOLGY	29.342	27.078	28.878	24.158
62307A	LASER WEAPON TECHNOLOGY	9.788	8.655	11.167	12.871
62601A	TANK AND AUTOMOTIVE TECHNOLOGY	19.572	21.952	23.363	21.908
62618A	BALLISTICS TECHNOLOGY	42.757	45.520	30.948	34.909
62622A	CHEMICAL AND SMOKE MUNITIONS	57.931	59.177	45.444	42.387
62623A	JOINT SERVICE SMALL ARMS PROGRAM	7.356	11.777	13.593	15.553
62624A	WEAPONS AND MUNITIONS TECHNOLOGY	35.176	20.197	24.931	30.997
62705A	ELECTRONICS AND ELECTRONIC DEVICES	21.047	20.794	21.775	22.499
62709A	NIGHT VISION INVESTIGATIONS	19.152	26.111	22.584	24.817
62715A	TAC ELECTRONIC WARFARE TECHNOLOGY	8.642	12.484	0.0	0.0
62716A	HUMAN FACTORS ENG SYS DEV	12.296	17.359	15.372	15.071
62720A	ENVIRONMENTAL QUALITY HEALTH	11.405	11.468	9.923	9.581
62727A	NON-SYSTEM TRAINING DEVICES	2.838	4.230	4.011	3.429
62770A	MILITARY DISEASE HAZARDS TECH	26.916	43.293	49.435	49.635
62782A	C3 TECHNOLOGY	21.407	33.771	16.792	29.578
62783A	COMPUTER & SOFTWARE TECHNOLOGY	11.095	8.872	8.227	6.461
62784A	MILITARY ENGINEERING TECHNOLOGY	39.574	42.967	42.426	49.552
62785A	MANPOWER/PSNL/TRAINING TECHNOLOG	11.799	15.216	15.581	17.981
62786A	LOGISTICS TECHNOLOGY	30.059	33.019	42.603	45.182
62787A	MEDICAL TECHNOLOGY	58.272	68.255	60.762	63.310
	TECHNOLOGY BASE TOTAL	804.525	853.437	824.173	850.300
	ADVANCED TECHNOLOGY DEVELOPMENT				
63001A	LOGISTICS ADVANCED TECHNOLOGY	13.044	15.323	16.475	19.343
63002A	MEDICAL ADVANCED TECHNOLOGY	40.382	32.663	39.164	51.772
63003A	AVIATION ADVANCED TECHNOLOGY	60.079	60.007	48.708	40.810
63004A	WEAPONS AND MUNITIONS ADVANCED TECH	30.362	23.454	24.914	41.562
63005A	COMBAT VEH & AUTO ADV TECH	52.930	37.658	48.774	54.262
63006A	C3 ADV TECH	10.876	12.940	7.485	9.759
63007A	HUMAN FACTORS/PSNL/TNG ADV TECH	36.508	27.151	38.164	46.677
63008A	ELECTRONIC WARFARE ADV TECH	10.725	13.798	0.0	0.0
63102A	MATERIALS AND STRUCTURES	10.895	14.575	8.185	9.206
63105A	ACQUIRED IMMUNE DEFICIENCY RESEARCH	32.890	21.711	5.000	12.000
63255A	OPERATIONAL ENHANCEMENTS	0.0	0.0	7.757	14.228
63313A	MSL/ROCKET COMPONENTS	22.116	31.817	20.321	16.363
63314A	HIGH ENERGY LASER & DIRECTED ENERGY	0.0	0.0	7.831	32.387
63321A	TARGET ACQUISITION & CCM	24.628	18.375	0.0	0.0
63324A	ARMY DEVELOPMENT AND EQUIP ACTIVITY	11.277	9.617	11.936	17.288
63606A	LANDMINE WARFARE/BARRIER DEV	14.539	24.849	10.675	11.579
63607A	JOINT SERVICE SMALL ARMS PROGRAM	5.949	6.617	10.820	9.564
63710A	NIGHT VISION ADVANCED DEVEL	30.139	25.966	23.653	26.169
63734A	ENGINEERING SYSTEMS	1.815	3.851	4.699	2.338
63742A	ADV ELECTRONIC DEVICES DEV	8.577	2.405	7.089	7.924
63752A	DEMILITARIZATION CONCEPTS	8.905	0.0	0.0	0.0
63756A	DOD SOFTWARE INITIATIVES (STARS)	27.039	0.0	0.0	0.0
63758A	ARMY BATTLEFIELD TECH INTEGRATION	11.142	11.351	12.221	9.601
63759A	CB DEF/SMK ADV TECH DEMOS	6.693	2.283	4.734	3.450
63772A	ADV TACTICAL COMPUTER SCIENCE TECH	11.749	4.810	6.117	8.501
	TOTAL ADVANCED TECH DEVELOPMENT	483.259	401.221	400.711	488.782
	STRATEGIC PROGRAMS				
12814A	SPECIAL PROGRAM	0.0	0.0	0.0	0.0
12821A	CLASSIFIED PROGRAM	0.0	0.0	0.0	0.0
33152A	WORLDWIDE MILITARY CMD/CNT INF SYS	28.736	28.423	0.0	0.0
	TOTAL STRATEGIC PROGRAMS	223.064	219.319	98.136	87.233
	TACTICAL PROGRAMS				
63220A	ADV ROTORCRAFT TECH INTEG/LHX	41.809	42.575	0.0	0.0
63302A	ANTI-TACTICAL MISSLE SYSTEM	56.595	28.913	29.501	85.853

PROGRAM ELEMENT NUMBER	ITEM NOMENCLATURE	FY86	FY87	FY88	FY89
63303A	SURF-TO-SURF MSL ROCKET SYS	28.466	41.042	29.560	37.071
63323A	LIGHT WEIGHT AIR DEFENSE SYSTEM	0.0	9.617	0.0	0.0
63604A	NUCLEAR MUNITIONS AND RADIACS	9.775	5.957	0.0	0.0
63612A	ADV ANTI-TANK WEAPON SYS(MEDIUM)	56.770	56.783	59.146	117.446
63619A	LANDMINE/BARRIER SYSTEM	25.294	6.171	15.797	16.845
63627A	SMOKE MUNITIONS & MATERIEL CONCEPTS	6.478	2.509	9.707	8.518
63633A	TANK-FIGHTING VEH AMMO DEVELOPMENT	5.330	0.0	0.0	0.0
63642A	EVOLUTIONARY SAM	0.0	0.0	0.0	3.061
63645A	ARMORED FAMILY OF VEHICLES ADV DEV	0.0	0.0	9.814	44.970
63705A	PHYSICAL SECURITY	3.863	2.251	0.0	2.907
63706A	IDENT FRIEND OR FOE DEVELOPMENT	17.392	19.723	18.270	14.940
63711A	AIRCRAFT SURVIVABILITY EQUIPMENT	5.121	3.559	6.767	12.548
63713A	ARMY DATA DISTRIBUTION SYSTEM	33.354	35.697	33.855	25.500
63718A	ELECT WRFR VULNERABILITY/SUSCEPT.	18.683	13.002	15.464	16.546
63725A	REMOTELY PILOTED VEHICLES & DRONES	3.988	9.691	11.546	6.598
63730A	TACTICAL SURVEILLANCE SYSTEM	20.175	8.678	0.0	0.0
63738A	NON-SYSTEM TRAINING DEVICES	1.875	3.722	0.0	.862
63740A	FAADS C3I ADV DEV	0.0	4.809	4.337	0.0
63745A	TAC ELECTRONIC SPT MEASURE SYSTEM	4.524	7.776	0.0	0.0
63746A	SINGLE CHAN GND & ABN RADIO SYSTEM	1.217	0.0	0.0	0.0
63747A	SOLDIER SUPPORT/SURVIVABILITY	4.584	4.227	3.864	4.553
63751A	MED DEFENSE AGAINST CHEM WARFARE	29.264	25.495	27.112	28.997
63755A	TACTICAL ELEC COUNTERMEASURES SYS	32.089	24.046	0.0	0.0
63757A	FORWARD AREA AIR DEFENSE SYSTEMS	41.555	80.719	131.608	166.461
63760A	SOF EQUIPMENT ADV DEV	0.0	0.0	20.421	21.579
63766A	TAC ELECTRONIC SURVEILLANCE SYS	6.340	11.670	0.0	0.0
63774A	NIGHT VISION SYS ADV DEVELOPMENT	.382	.283	4.944	3.932
63775A	LIGHT ARMORED/WEASEL EVALUATION	0.0	9.921	0.0	0.0
63776A	ABN ADVERSE WEATHER WEAPONS SYS	0.0	0.0	97.726	87.339
63801A	AVIATION ADVANCED DEVELOPMENT	8.593	8.258	3.041	4.362
63802A	WEAPONS &MUNITIONS ADV DEV	9.616	21.263	10.785	12.288
63803A	CHEMICAL SYSTEMS ADV DEV	18.950	24.037	15.325	0.0
63804A	LOG & ENGR EQUIPMENT ADV DEV	32.206	22.920	20.505	18.987
63805A	CSS COMPUTER SYSTEM EVAL/ANALYSIS	3.647	4.497	1.195	1.426
63806A	CHEM/BIO DEFENSE EQUIP ADV DEV	22.779	10.032	6.485	5.513
63807A	MEDICAL SYSTEMS ADV DEV	25.665	23.817	21.863	24.379
64202A	AIRCRAFT WEAPONS	24.107	2.481	9.789	12.500
64206A	UH-60 BLACKHAWK	15.802	0.0	0.0	0.0
64216A	LHX AIRCRAFT PROPULSION	65.417	94.714	135.073	65.938
64220A	ARMY HELICOPTER IMPROVEMENT PROGRAM	8.122	0.0	0.0	0.0
64223A	ADVANCED TECH LIGHT HELO SERIES	0.0	0.0	267.212	532.064
64306A	STINGER	21.920	6.977	4.820	0.0
64307A	PATRIOT AIR DEFENSE MISSILE SYSTEM	47.700	0.0	0.0	0.0
64310A	HELIBORNE MISSILE - HELLFIRE	4.655	1.985	0.0	0.0
64313A	GRASS BLADE	10.112	2.914	12.798	14.615
64321A	JOINT TACTICAL FUSION PROGRAM	149.341	154.418	0.0	0.0
64324A	JOINT TACTICAL MISSLE SYSTEM-ARMY	109.310	84.807	112.208	86.618
64603A	NUCLEAR MUNITIONS	20.073	18.682	0.0	0.0
64604A	MOBILITY	.930	0.0	35.267	23.555
64609A	SMOKE MUNITIONS AND MATERIEL	.779	7.590	10.072	13.229
64611A	ADVANCED ANTI-TANK WEAPON ENG DEV	0.0	0.0	0.0	114.239
64630A	M1A1 DEVELOPMENT PROGRAM	17.665	3.654	0.0	0.0
64632A	105MM TANK AMMUNITION	.054	0.0	0.0	0.0
64702A	JT TACTICAL INFORMATION DIST SYS	14.208	0.0	4.307	0.0
64704A	UNATTENDED GROUND SENSORS	.465	0.0	0.0	0.0
64709A	ID FRIEND OR FOE EQUIP DEV	0.0	.500	19.073	33.181
64710A	NIGHT VISION DEVICES	13.677	10.525	15.271	22.630
64711A	AIRCRAFT SURVIVABILITY EQUIPMENT	18.912	19.063	8.001	18.283
64713A	COMBAT FEEDING, CLOTHING AND EQUIP	4.786	3.466	1.333	3.244
64715A	NONSYSTEM TRAINING DEVICES ENGR	41.174	44.211	32.539	24.867
64718A	PHYSICAL SECURITY	7.415	7.159	6.784	4.894
64722A	EDUCATION AND TRAINING	8.383	4.211	5.447	6.889
64723A	SPECIAL PURPOSE DETECTORS	1.827	1.137	1.430	.484
64726A	METEOROLOGICAL EQUIP & SYSTEMS	3.769	1.162	1.339	1.615
64730A	REMOTELY PILOTED VEHICLES	80.315	61.813	32.620	29.600
64737A	UNMANNED AERIAL VEHICLES - ENG DEV	0.0	0.0	8.284	11.138
64740A	TACTICAL SURVEILLANCE SYSTEM	16.657	13.649	0.0	0.0
64741A	DIV AIR DEFENSE COMMAND & CONTROL	20.111	39.539	108.016	167.254
64746A	AUTOMATIC TEST EQUIPMENT DEVELOP	9.702	11.893	8.884	14.408

PROGRAM ELEMENT NUMBER	ITEM NOMENCLATURE	FY86	FY87	FY88	FY89
64750A	TACTICAL ELEC COUNTERMEASURES SYS	9.138	11.639	0.0	0.0
64757A	MEDICAL CHEM DEFENSE LIFE SPT MAT	1.595	8.852	7.705	8.529
64766A	TACTICAL ELEC SURVEILLANCE SYS	10.476	15.884	0.0	0.0
64770A	JOINT SURVEIL/TARGET ATTACK RADAR	44.636	26.811	23.396	15.430
64779A	JT INTEROP OF TAC CMD & CONT SYS	15.953	13.305	18.360	17.828
64801A	AVIATION ENG DEV	8.771	11.728	12.165	13.089
64802A	WEAPONS & MUNITIONS ED	60.118	108.490	111.904	133.919
64803A	CHEMICAL SYSTEMS ED	0.0	0.0	15.325	29.370
64804A	LOG & ENGR EQUIP ED	23.469	18.976	14.830	18.150
64805A	C3 ED	23.332	19.136	15.851	10.356
64806A	CHEM/BIO DEFENSE EQUIP ED	20.187	35.567	24.122	20.205
64807A	MEDICAL MATERIEL/MEDICAL BIO DEF ED	11.521	13.641	13.453	17.998
64808A	LANDMINE WARFARE/BARRIER EQUIP ED	15.896	16.941	7.343	14.969
65710A	JOINT CB POC, TEST & ASSESSMENT	6.546	6.012	6.403	6.531
23726A	ADV FIELD ARTILLERY TACT DATA SYS	18.828	10.301	40.857	25.753
23727A	MED ANTI-TANK ASSAULT WEAPON DRAGON	.563	0.0	0.0	0.0
23735A	COMBAT VEHICLE IMPROVEMENT PGM	66.864	93.858	103.968	81.170
23739A	AN/TSQ-73 MODIFICATIONS	0.0	9.300	14.637	18.833
23740A	MANEUVER CONTROL SYSTEM	11.955	9.581	13.973	12.004
23743A	155MM	26.133	34.397	46.978	24.513
23744A	AIRCRAFT MODIFICATIONS	10.767	0.0	18.429	4.832
23745A	EQUIPMENT UPGRADE	32.120	42.291	15.137	4.845
23751A	SPECIAL OPERATIONS FORCES EQUIPMENT	0.0	43.218	95.472	29.829
23752A	AIRCRAFT ENGINE COMPONENT IMPROV	9.500	7.247	6.144	7.744
23801A	MISSILE/AIR DEFENSE PIP	17.554	39.678	60.527	64.359
28010A	JOINT TAC COMMO PROGRAM (TRITAC)	27.861	15.140	15.102	13.958
33145A	EUCOM C3 SYSTEMS	4.704	1.038	1.289	.636
	TOTAL TACTICAL PROGRAMS	1,957.347	2,050.978	2,882.235	3,464.368
	INTELLIGENCE AND COMMUNICATIONS				
63712A	MAPPING AND GEODESY	4.378	0.0	0.0	0.0
64201A	AIRCRAFT AVIONICS	1.114	2.398	0.0	0.0
64716A	MAPPING AND GEODESY	2.096	.266	7.459	6.488
64778A	NAVSTAR GLOBAL POS SYS (GPS)	10.491	4.539	13.732	8.803
33126A	LONG-HAUL COMMUNICATIONS (DCS)	3.008	2.591	0.0	0.0
33142A	SATCOM GROUND ENVIRONMENT	54.978	74.518	86.725	46.694
33401A	COMMUNICATIONS SECURITY (COMSEC)	8.911	7.001	5.217	5.126
	TOTAL INTEL & COMMO	94.095	102.281	124.214	74.899
	DEFENSEWIDE MISSION SUPPORT				
63790A	NATO RESEARCH AND DEVELOPMENT	23.238	47.464	0.0	0.0
65301A	KWAJALEIN MISSLE RANGE	148.838	151.081	170.374	184.957
65502A	SML BUSINESS INNOVATIVE RESEARCH	34.382	0.0	0.0	0.0
65702A	SUPPORT OF DEVELOPMENTAL TESTING	17.897	17.007	19.309	20.155
65601A	ARMY TEST RANGES AND FACILITIES	385.838	235.137	199.864	209.732
65602A	ARMY TECH TEST INSTRU & TARGETS	10.541	18.146	84.939	79.182
65603A	ARMY USER TEST INSTRU & THREAT SIMU	36.594	73.856	78.332	73.188
65706A	MATERIEL SYSTEMS ANALYSIS	20.295	21.383	25.179	26.413
65709A	EXPLOITATION OF FOREIGN ITEMS	3.330	3.838	4.392	4.362
65712A	SUPPORT OF OPERATIONAL TESTING	44.272	45.786	54.016	61.484
65801A	PROGRAM WIDE ACTIVITIES	161.464	79.320	88.514	87.835
65802A	INTL COOPERATIVE RESEARCH AND DEV	.881	.941	1.093	1.136
65803A	TECHNICAL INFO ACTIVITIES	5.170	4.981	6.285	6.403
65805A	MUN STANDARD EFFECTIVENESS & SAFETY	10.699	10.697	14.334	16.185
65810A	RDTE SUPP FOR NON-DEVELOP ITEMS	10.531	7.503	7.842	8.283
65872A	PRODUCTIVITY INVESTMENTS	20.160	27.790	38.382	31.576
65894A	REAL PROPERTY MAINTENANCE (RDT&E)	0.0	154.632	168.485	171.106
65896A	BASE OPERATIONS (RDT&E)	0.0	188.673	186.087	189.524
65898A	MGT HQ (RESEARCH/DEVELOPMENT)	11.404	11.151	13.372	13.727
78011A	INDUSTRIAL PREPAREDNESS	69.465	27.995	20.904	22.015
	TOTAL DEFENSE SUPPORT	1,014.999	1,127.381	1,181.703	1,207.263
	TOTAL RDT&E	4,577.289	4,754.617	5,511.172	5,972.845

NOTE: COLUMNS WILL NOT ADD TO THE TOTALS SHOWN DUE TO THE ABSENCE OF CLASSIFIED PROGRAM FUNDING.

FY88/FY89 AIRCRAFT PROCUREMENT, ARMY

SSN	ITEM NOMENCLATURE	FY86	FY87	FY88	FY89
	FIXED WING				
A05901	GOLDEN KNIGHTS REPLACEMENT AIRCRAFT	0.0	0.0	13.6	0.0
A10500	C-20 AIRCRAFT	0.0	40.0	0.0	0.0
A02700	C-12 CARGO AIRPLANE	11.4	11.7	0.0	0.0
A05800	CESSNA SKYLANE	0.0	0.0	.2	0.0
A02005	RC-12D RECON AIRPLANE	0.0	0.0	45.5	97.3
	TOTAL FIXED WING	11.4	51.7	68.2	97.3
	ROTARY WING				
A04300	EH-60A HELICOPTER (QUICKFIX)	93.0	110.2	20.7	51.2
A04300	EH-60A HELICOPTER (QUICKFIX) ADV PROC	28.5	16.3	9.6	0.0
A06605	AH-64 ATTACK HELICOPTER (APACHE)	1034.1	1004.4	654.6	77.7
A06605	AH-64 ATTACK HELICPTR(APACHE)ADV PROC	62.4	38.2	0.0	0.0
A05002	UH-60A BLACK HAWK (MYP)	199.2	202.1	245.0	297.3
A05002	UH-60A BLACK HAWK (MYP) ADV PROC	186.9	161.3	208.4	189.2
	TOTAL ROTARY WING	1,604.1	1,532.5	1,138.3	615.4
	MODIFICATIONS				
AZ3530	OV-1 MOHAWK SURVEILLANCE AIRPLANE	19.3	9.8	17.5	31.6
AZ2100	RV-1 RECON AIRPLANE	0.0	2.6	0.0	12.5
AA0150	AH1S ATTACK HELICOPTER (COBRA-TOW)	93.5	25.4	0.0	29.3
AA6605	AH-64 MODS	0.0	32.6	78.8	44.0
AA0250	CH-47 CARGO HELICOPTER (MYP)	164.6	198.7	168.3	181.6
AA0250	CH-47 CARGO HELICOPTER (MYP) ADV PROC	110.6	57.3	63.6	83.8
AA0300	CH-54 CARGO HELICOPTER (TARHE)	.5	1.3	0.0	0.0
AA0400	OH-58 OBSERVATION HELICOPTER (KIOWA)	27.7	0.0	37.0	80.4
AA0600	UH-1 UTILITY HELICOPTER (IROQUOIS)	11.6	6.2	9.4	8.3
AA0490	UH-60 BLACKHAWK MODS	32.8	7.5	33.8	33.6
AZ2200	ARMY HELO IMPROVEMENT PROGRAM (AHIP)	150.1	124.8	48.1	0.0
AZ2200	ARMY HELO IMPROVEMENT PROGRAM ADV PROC	28.1	22.0	0.0	0.0
AA0700	AIRBORNE AVIONICS	1.7	.1	1.0	2.7
AA0720	ASE MODIFICATIONS CLOSE COMBAT	0.0	3.4	.1	13.1
AA0725	MODIFICATIONS UNDER $2.0M (AIRCRAFT)	.4	.1	0.0	0.0
AZ3405	ACFT 9WW	15.5	11.7	25.8	24.0
AZ3407	SOF AIRCRAFT MODIFICATIONS	0.0	0.0	121.8	237.2
	TOTAL MODIFICATIONS	656.4	503.5	605.2	782.1
	SPARES AND REPAIR PARTS				
AA0950	SPARE PARTS	732.7	558.6	512.1	553.0
	TOTAL SPARES & REPAIRS	732.7	558.6	512.1	553.0
	SUPPORT EQUIPMENT AND FACILITIES				
AZ3504	AIRCRAFT SURVIVABILITY EQUIPMENT	0.0	11.3	68.7	98.0
AZ3504	AIRCRAFT SURVIVABILITY EQUIP ADV PROC	0.0	0.0	12.0	0.0
AZ3000	AVIONICS SUPPORT EQUIPMENT	47.4	44.9	23.6	22.2
AZ3100	COMMON GROUND EQUIPMENT	41.7	27.7	28.1	38.7
AA0050	AIR TRAFFIC CONTROL	8.6	4.7	2.9	0.0
AZ3800	SYNTHETIC FLIGHT TRAINING SYSTEMS	112.9	0.0	0.0	0.0
AZ3300	INDUSTRIAL FACILITIES	56.1	15.6	17.6	12.2
A50100	WAR CONSUMABLES	5.6	4.4	3.1	3.1
	TOTAL SUPPORT EQUIPMENT & FACILITIES	272.3	108.6	156.0	174.2
	TOTAL AIRCRAFT APPROPRIATION	3,277.00	2,754.9	2,474.0	2,229.5

FY88/FY89 MISSILE PROCUREMENT

SSN	ITEM NOMENCLATURE	FY86	FY87	FY88	FY89
	SURFACE-TO-AIR MISSILE SYSTEM				
C22100	CHAPARRAL	122.4	28.5	34.2	58.4
CC2100	NON LINE OF SIGHT AIR DEFENSE SYSTEM	0.0	0.0	0.0	9.8
CC2100	NLOS ADVANCE PROCUREMENT	0.0	0.0	0.0	56.1
CA6000	CLASSIFIED PROGRAM	0.0	0.0	0.0	0.0
CC2200	AIR DEFENSE SYS HEAVY	0.0	0.0	59.4	264.0
CA0275	OTHER MISSLE SUPPORT	4.8	6.2	4.5	5.5
C49100	PATRIOT (MYP)	874.8	917.0	851.4	804.1
C49100	PATRIOT (MYP) ADV PROC	0.0	45.3	40.1	37.4
C18500	STINGER (MYP)	229.4	261.4	154.2	200.3
C18500	STINGER (MYP) ADV PROC	0.0	30.0	45.5	44.0
CC9803	PEDESTAL MOUNTED STINGER (PMS)	0.0	0.0	55.8	115.2
	TOTAL SURFACE-TO-AIR SYSTEMS	1,231.4	1,288.4	1,245.1	1,594.8
	AIR-TO-AIR MISSILE SYSTEM				
C70000	LASER HELLFIRE SYSTE	212.3	0.0	168.4	146.8
	TOTAL AIR-TO-AIR MISSILE SYSTEM	212.3	0.0	168.4	146.8
	ANTI-TANK/ASSULT MISSILE SYSTEM				
C59300	TOW 2	151.9	106.3	131.2	117.0
C59300	TOW 2 ADV PROC	22.0	0.0	0.0	0.0
C76500	PERSHING	212.8	30.6	6.7	6.6
C67600	MULTIPLE LAUNCH ROCKET SYSTEM (MYP)	428.1	456.1	424.4	417.0
C67600	MULTIPLE LAUNCH ROCKET SYSTEM ADV PROC	41.0	0.0	22.7	0.0
C98510	ARMY TACTICAL MISSILE SYSTEM	0.0	0.0	15.1	77.0
	ATACMS ADV PROC	0.0	0.0	1.8	4.3
	TOTAL ANTI-TANK/ASSULT MISSILES	855.8	593.0	601.9	621.9
	MODIFICATIONS				
C50700	PATRIOT	14.2	21.1	40.0	40.4
C24200	CHAPARRAL	87.6	5.0	31.2	65.1
C35200	HAWK	44.0	48.4	35.7	51.9
C61700	TOW	11.6	50.9	18.0	26.1
C57300	DRAGON	0.0	0.0	7.3	17.5
C76200	LANCE MODIFICATIONS	0.0	3.7	15.3	5.2
C92800	PERSHING MODIFICATIONS	0.0	0.0	9.3	9.0
C67500	MLRS	0.0	0.0	4.5	33.9
C54000	AN/TSQ-73	0.0	0.0	0.0	1.3
	TOTAL MODIFICATIONS	157.4	129.1	161.3	250.4
	SPARES AND REPAIR PARTS				
CA0250	SPARES AND REPAIR PARTS	253.6	140.4	246.6	250.7
	TOTAL SPARES AND REPAIR PARTS	253.6	140.4	246.6	250.7
	SUPPORT EQUIPMENT AND FACILITIES				
C93000	AIR DEFENSE TARGETS	18.5	26.4	21.4	39.3
CL2000	ITEMS LESS THAN $2.0M (MISSILES)	3.0	1.5	2.1	2.1
CA0100	PRODUCTION BASE SUPPORT	26.9	15.0	11.6	9.0
CA4600	OTHER PRODUCTION CHARGES	1.9	0.0	0.0	0.0
	TOTAL SUPPORT EQUIPMENT AND FACILITIES	50.3	42.9	35.1	50.4
MISSILE PROCUREMENT APPROPRIATIONS TOTALS		2,760.6	2,193.8	2,458.5	2,923.2

NOTE: COLUMNS WILL NOT ADD TO THE TOTALS SHOWN DUE TO THE ABSENCE OF CLASSIFIED DATA.

FY88/FY89 PROCUREMENT OF WEAPONS AND TRACKED COMBAT VEHICLES

SSN	ITEM NOMENCLATURE	FY86	FY87	FY88	FY89
	TRACKED COMBAT VEHICLES				
G80300	CARRIER,COMMAND POST LIGHT,FT,M577A2	18.1	44.6	0.0	0.0
G80711	CARRIER, PERSONNEL, FT, ARM, M113A3	97.2	0.0	0.0	0.0
G80702	BRADLEY FIGHTING VEHICLES (MYP)	711.4	826.8	699.4	671.2
G80702	BRADLEY FIGHTING VEH (MYP) ADV PROC	24.2	10.3	37.1	42.8
G20900	BRADLEY (BFVS) TRAINING DEVICES	64.6	9.2	0.0	0.0
GZ2500	BRADLEY (BFVS) TRAINING DEVICES (MOD)	0.0	0.0	5.9	3.8
G80100	FIELD ARTILLERY AMMUNITION SUPPORT VEH	58.4	60.3	28.7	0.0
G82500	RECOVERY VEHICLE, MED, FT, M88A1	173.4	0.0	0.0	83.8
G82500	REC VEHICLE M88A1 .. ADV PROCUREMENT	0.0	0.0	24.1	22.3
G82916	ABRAMS TANK SERIES ROLL (MYP)	1471.1	1566.4	1354.7	1215.2
G82916	ABRAMS TANK SERIES ROLL (MYP) ADV PROC	281.4	233.0	156.0	146.1
GC2600	M60 SERIES TANK TRAINING DEVICES	21.0	32.3	0.0	30.0
GB1300	M1 SERIES TANK TRAINING DEVICES	58.0	8.7	4.7	10.5
	TOTAL TRACKED COMBAT VEHICLES	2,978.8	2,791.5	2,310.6	2,225.7
	MODIFICATION OF TRACKED COMBAT VEHICLES				
GB1930	CARRIER, MOD	49.0	40.4	42.6	52.5
GZ2300	FIST VEHICLE (MOD)	68.4	51.9	0.0	0.0
GZ2400	BFVS SERIES (MOD)	11.4	33.9	52.1	62.9
GA0400	HOWITZER, MED SP FT 155MM M109 (MOD)	5.4	2.9	28.2	38.7
GZ3000	ARMORED VEH LAUNCH BRIDGE (AVLB) (MOD)	9.3	0.0	0.0	0.0
GA0650	TANK, COMBAT, FT, 105MM GUN,M60SER(MOD)	80.8	46.6	23.3	35.6
GA0700	TANK, M1 SERIES (MOD)	40.2	49.4	37.5	46.4
GZ3405	9WW	0.0	0.0	.7	.6
GA9002	MOBILE TRAINING BASE EQUIP	0.0	6.8	0.0	0.0
GA9003	HOST NATION SUPPORT	0.0	4.5	29.7	5.
	TOTAL MODIFICATIONS	264.5	236.4	214.1	241.7
	SUPPORT EQUIPMENT AND FACILITIES				
GA0150	SPARES AND REPAIR PARTS (TCV-WTCV)	535.3	424.6	398.4	500.6
GL3100	ITEMS LESS THAN $2.0M (TCV-WTCV)	.8	1.9	1.9	1.7
GA0050	PRODUCTION BASE SUPPORT (TCV-WTCV)	82.0	53.8	28.7	36.8
GA2449	REGIONAL MAINTENANCE TNG SITES	0.0	0.0	17.1	16.2
	TOTAL SUPPORT EQUIPMENT & FACILITIES	618.1	480.3	446.1	555.3
	WEAPONS AND OTHER COMBAT VEHICLES				
G01300	HOWITZER, LIGHT, TOWED, 105MM, L119	0.0	25.6	29.9	28.8
G01402	HOWITZER, MED, TOWED, 155MM, M198	0.0	0.0	0.0	19.9
G11101	MACHINE GUN, 7.62MM, M60	0.0	4.8	0.0	0.0
G13000	ARMOR MACHINE GUN, 7.62MM M240	15.8	0.0	0.0	0.0
GB2000	MACHINE GUN, CAL50 M2	8.0	0.0	0.0	0.0
G12901	SQUAD AUTOMATIC WEAPON (SAW) 5.56MM	0.0	12.4	12.1	12.5
G13400	GRENADE LAUNCHER, AUTO, 40MM, MK 19-3	0.0	15.0	13.8	12.0
G71100	LAUNCHER, SMOKE GRENADE	2.1	1.7	1.9	1.6
G02202	MORTAR, 81MM, M252	5.4	9.7	0.0	0.0
G03000	MORTAR, 120MM	4.8	12.7	20.9	23.8
G14900	M16 RIFLE	35.1	35.5	26.1	26.1
G04200	SNIPER WEAPON SYSTEM	2.0	0.0	1.9	1.9
G15300	PERSONAL DEFENSE WEAPON, 9MM	5.2	4.4	5.3	7.0
G21100	VEH RAPID FIRE WPN SYS-BUSHMAST(MYP)	30.4	33.6	25.8	32.5
G21100	VEH RAPID FIRE-BUSHMASTER ADV PROC	13.1	3.2	2.1	2.4
G21400	TANK MUZZLE BORESIGHT DEVICE	1.7	0.0	0.0	0.0
G23100	SHOLDER LAUNCHED MULTIPURP ASSL WPN	1.0	0.0	0.0	0.0
	TCTAL WEAPONS & OTHER COMBAT VEHICLES	124.6	158.6	139.8	168.5
	MODIFICATION OF WEAPONS AND OTHER COMBAT VEHICLES				
GA0425	HOWITZER, 155mmM114A2	1.6	0.0	0.0	0.0
GZ2800	M16A1 RIFLE MODS	3.1	3.2	5.4	5.8
GC0925	MODIFICATIONS UNDER $2.0M (WOCV-WTCV)	.5	3.9	4.5	0.0
	TOTAL MODEFICATIONS OF WEAPONS & OTHER	5.2	7.1	9.9	5.8
	SUPPORT EQUIPMENT AND FACILITIES				
GC0150	SPARES AND REPAIR PARTS (WOCV-WTCV)	4.7	17.0	12.0	18.7
GL3200	ITEMS LESS THAN $2.0M (WOCV-WTCV)	2.8	3.2	3.3	2.2
GC0050	PRODUCTION BASE SUPORT (WOCV-WTCV)	38.2	35.7	16.7	9.8
	TOTAL SUPPORT EQUIPMENT & FACILITIES	45.7	55.9	32.0	30.7
	TOTAL WEAPONS AND TRACKED COMBAT VEH	4,037.4	3,729.9	3,152.5	3,227.8

FY88/FY89 AMMUNITION PROCUREMENT

SSN	ITEM NOMENCLATURE	FY86	FY87	FY88	FY89
	ATOMIC MATERIEL				
EA0050	NUCLEAR WEAPONS SUPPORT MATERIEL	4.9	2.6	2.4	3.9
E82700	PROJ, NUCLEAR, 155MM	0.0	11.4	0.0	0.0
	TOTAL ATOMIC MATERIEL	4.9	14.0	2.4	3.9
	CONVENTIONAL AMMUNITION				
E00701	CTG, 5.56MM, BALL M193	10.2	14.3	8.2	8.2
E00702	CTG, 5.56MM, TRACER	0.0	5.5	0.0	0.0
E00703	CTG, 5.56MM, TRACER CLIP	0.0	4.7	1.2	2.6
E01100	CTG, 5.56MM, BLANK M200	9.5	12.9	16.3	15.6
E01101	CTG, 5.56MM, BLK M200, LKD F/SAW	2.1	12.0	5.9	0.0
E04600	CTG, 5.56MM,4 BALL M855/1 TRCRM856LKD	9.1	28.9	0.0	0.0
E75500	CTG, 5.56MM,PLASTIC M862	0.0	1.9	2.7	2.2
E04601	CTG, 5.56MM, BALL M16-A2	26.4	3.3	8.1	22.3
E04602	CTG, 5.56MM, TRACER M16-A2	6.1	0.0	4.9	4.9
E02002	CTG, 7.62MM, 4 BALL M80/1 TRCR M62 LKD	21.9	25.0	14.3	12.6
E02003	CTG, 7.62MM, BALL M80 LKD/M13	.7	2.6	0.0	2.6
E02007	CTG, 7.62MM, LKD 4 BALL ITRACER OHF	1.9	.5	0.0	2.1
E01902	CTG, 7.62MM, BLANK M82 LKD/M13	.9	15.9	13.0	12.1
E05700	CTG, CAL .45, BALL M1911	2.1	.7	1.3	1.5
E07000	CTG, CAL.50,PLASTIC LKD4 BALL/ 1 TRCR	0.0	5.3	2.3	3.0
E06400	CTG, CAL 50,LKD 4 BALL/1 TRCR W/M15A2LK	10.7	2.6	0.0	1.5
E06800	CTG, CAL .50, APIT, M20 LKD	1.3	2.0	0.0	0.0
E07100	CTG, CAL .50, BALL LKD	3.6	2.5	0.0	0.0
E07200	CTG, CAL 50, LKD 4 BALL/1 TRCR W/M9 LK	43.9	8.1	0.0	0.0
E08904	CTG, 20MM,LKDTP-T M220 SER MLB M14A2	12.8	11.1	12.6	13.1
E08902	CTG, 20MM, LKD 4 TP M55A2/1TP-T M220	0.0	5.2	4.0	4.2
E08201	CTG, 25MM, HEI-T M792 W/F	23.7	23.8	6.9	19.5
E08202	CTG, 25MM, APDS-T M791 W/M28(MYP)	10.6	0.0	0.0	0.0
E08203	CTG, 25MM, TPT LKD M793 MLB M28	39.2	24.5	11.0	14.8
E08205	CTG, 25MM, AP TRAINING	0.0	0.0	0.0	36.2
E09900	CTG, 30MM, LKD HEDP M789 W/FUZE	4.8	0.0	0.0	0.0
E10100	CTG, 30MM, LKD PT M788	8.8	2.4	0.0	4.5
E10200	CTG, 30MM, DUMMY, M838	.3	0.0	0.0	0.0
E11800	CTG, 40MM, HEDP M430	41.4	39.2	9.9	25.0
E71100	CTG, 40MM, TP F/MK19	6.5	21.0	28.5	26.3
E13300	CTG, 40MM, GREEN STAR PARACHUTE	0.0	0.0	2.3	1.3
E13800	CTG, 40MM, PRAC M781	4.4	3.0	3.2	3.9
E12100	CTG, 40MM,WHT STAR CLUSTER M585 F/LCHR	0.0	0.0	6.5	2.7
E12400	CTG, 40MM, RED STAR, PARACHUTE	0.0	0.0	1.7	1.7
E13201	CTG, 40MM, CS	0.0	0.0	2.6	4.4
E70401	CTG, 60MM, ILLUM, XM721	0.0	0.0	7.8	0.0
E70501	CTG, 60MM, SMK, XM722	0.0	0.0	4.5	4.5
E67303	CTG, 60MM, HE, M720W/M734	0.0	0.0	26.8	0.0
E15200	CTG, 75MM, BLANK, M337A1 F/HOWITZER	2.7	0.0	0.0	0.0
E76100	CTG, 81MM: ILLUM XM853	7.1	3.3	0.0	0.0
E18403	CTG, 81MM: HE, M821 W/FUZE M734 MO	45.4	37.6	60.2	0.0
E76200	CTG, 81MM: SMOKE, RP, XM819	5.9	14.8	0.0	0.0
E19800	CTG, 81MM: 1/10 RNG, PRAC, XM880	4.2	2.8	4.8	4.5
E25100	CTG, 4.2-IN HE M329A2 W/O FUZE	20.9	41.6	19.7	0.0
E25501	CTG, 120MM: HE, XM933, W/FUZE M734 MO	0.0	23.1	12.2	13.6
E25502	CTG, 120MM, HE, W/PD FUZE	0.0	0.0	4.4	6.6
E25503	CTG, 120MM: ILLUM, XM930	0.0	3.5	19.0	11.1
E25504	CTG, 120MM: SMOKE, XM929	0.0	7.3	9.9	13.5
E25505	CTG, 120MM, TNG 1/10	0.0	0.0	2.1	1.3
E21200	CTG, 105MM, BLK M395	0.0	0.0	3.2	0.0
E21701	CTG, 105MM, ILLUM M314	0.0	0.0	18.5	0.0
E24000	CTG, 105MM, TP-T, M490	30.5	18.0	4.9	17.5
E23901	CTG, 105MM, HEAT M456A2	.1	0.0	0.0	0.0
E22100	CTG, 105MM, DS-TP M724	81.9	41.6	37.8	28.9
E67901	CTG, 105MM, APFSDS-T M833	46.8	21.4	32.5	0.0
E67903	CTG, 105MM, APFSDS-T (XM900E1)	0.0	0.0	0.0	30.9
E73100	CTG, 120MM APFSDS-T M829	125.5	75.5	77.3	85.6
E73200	CTG, 120MM HEAT-MP-T, M830(MYP)	40.1	28.3	53.0	25.2
E73300	CTG, 120MM TPT-T M831	37.6	38.0	63.3	45.4
E73400	CTG, 120MM TPCSDS-T, M865(MYP)	61.7	91.7	83.7	76.3
E76160	CTG, SUBCAL 35MM F/TANK	0.0	1.9	2.0	1.9
E28100	PROJ, 155MM, HE, ICM M483	255.6	101.2	98.7	103.1
E67800	PROJ, 155MM, SMK, WP, M825	12.5	22.5	34.0	12.6

SSN	ITEM NOMENCLATURE	FY86	FY87	FY88	FY89
EA0001	PROVEOUT M483	0.0	30.0	0.0	0.0
E26901	PROJ, 155MM, ILLUM M485	0.0	0.0	43.6	0.0
E67100	PROJ, 155MM, HE ADAM M731	19.6	33.3	45.4	61.1
E67500	PROJ, 155MM, HE, RAAMS M718	0.0	8.6	31.7	0.0
E67502	PROJ, 155MM, HE RAAMS M741	67.0	40.2	0.0	0.0
E68500	PROJ, 155MM, BASEBLEED, XM864	0.0	31.0	70.1	107.4
E67600	PROJ, 155MM, HE COPPERHEAD (EA)	210.1	17.9	100.6	105.6
E28001	PROJ, 155MM, CHEM GB-2	20.6	59.3	0.0	0.0
E69800	PROJ, 155MM, TRAINING M804	0.0	0.0	14.5	14.4
E27201	CHARGE,PROPELLING,M155MM GREEN BAG M3	11.6	25.7	0.0	0.0
E27303	CHARGE,PROPELLING,M155MM,RED BAG M203	19.4	23.0	108.9	106.0
E27100	CHARGE,PROPELLING,M155MM,RED BAG M119	0.0	49.0	19.7	0.0
E28900	CTG, 165MM TP M623	0.0	0.0	0.0	7.7
E76500	PROJ, 8-INCH, ANTI-ARMOR (SADARM) XM836	0.0	0.0	0.0	19.8
E67001	PROJ, 8-INCH, HE, ICM (DP), M509	47.5	86.7	0.0	0.0
E66600	PROJ, 8-INCH, HE, RAP, M650	30.6	23.3	42.4	41.4
E62704	FUZE, PROXIMITY, M732	0.0	0.0	24.2	6.3
E62208	FUZE, PD M739/M739A1	0.0	9.7	0.0	0.0
E61302	FUZE, MTSQ M577/M577A1	46.9	24.7	43.2	19.3
E61503	FUZE, MTSQ M582/M582A1	10.0	11.0	11.7	11.6
E76300	FUZE, ET XM762	0.0	0.0	0.0	18.3
E63000	PRIMER, PERC, M82	2.7	2.9	2.6	.8
EA0800	TRAINING DEVICE, MINE SYSTEM	0.0	0.0	5.0	.2
E40601	GROUND IMP MINE SCAT SYS AP M74 (MYP)	0.0	0.0	6.5	0.0
E40602	GROUND IMP MINE SCAT SYS AT M75 (MYP)	0.0	0.0	5.3	0.0
E72194	CANISTER MINE (VOLCANO) PRACTICE XM88	0.0	1.9	1.6	7.7
E72195	CANISTER MINE (VOLCANO) XM87	0.0	40.0	34.5	45.6
E76900	MTR RKT 5 IN MK22 MOD4	10.8	8.9	13.7	7.3
E75100	LINE CHARGE M58A3 (MCLIC)	21.2	22.8	29.3	30.9
E64701	MINE AT XM84	0.0	0.0	0.0	6.7
E71200	MODULAR MINE PACK SYSTEM	0.0	30.9	62.5	52.9
E77100	PURSUIT DETERRENT MUNITION	0.0	2.1	12.1	0.0
E55400	DEMOLITION MUNITIONS & OTHER	24.3	17.2	28.5	23.3
E50700	DEMO KIT BANGALORE TORPEDO	2.9	0.0	0.0	0.0
E53700	CTG, 105MM HERA XM913	0.0	0.0	7.9	11.5
E36100	LIGHTWEIGHT MULTI-PURPOSE WEAPON	59.2	68.1	66.1	75.6
E32900	LIGHT WGT MULTI PURPOSE SYSTEM TRNR	2.9	7.2	3.2	3.2
E37327	HYDRA 70 RKT, MPSM HE M261 WHD (MYP)	.9	0.0	0.0	0.0
E37309	HYDRA 70 RKT HE/RS (M151/M433)	0.0	7.7	7.8	7.2
E37314	HYDRA 70 RKT ILLUM M257 WHD	0.0	19.6	0.0	0.0
E37330	HYDRA 70 SMOKE	0.0	.9	7.1	15.5
E37334	HYDRA 70 RKT, MPSM PRAC M267 WHD	15.0	21.1	14.1	14.0
E37335	HYDRA 70 RKT, HE/PD (M151/M423/MK66)	6.7	33.3	6.9	26.2
E37337	HYDRA 70 RKT, XM274 SIG PRACTICE	0.0	23.4	38.2	23.9
E34000	GRENADE, HAND, ALL TYPES	30.6	23.8	1.7	8.7
E33300	GREN SMK SCREENING RP L8A1/L8A3	8.1	2.1	0.0	0.0
E32500	GRENADE, SMOKE SCREENING IR M76	7.1	8.8	11.1	5.5
E46900	SIGNALS, ALL TYPES	16.3	15.6	16.0	10.4
E51200	SIMULATORS, ALL TYPES	22.0	7.0	6.4	12.0
	TOTAL CONVENTIONAL AMMUNITION	1,797.2	1,691.6	1,929.0	1,790.9
	MISCELLANEOUS				
EB0016	AMMO COMPONENTS/SUPPORT, ALL TYPES	21.2	19.8	21.7	21.3
E77000	CAD/PAD	.8	2.4	4.7	4.7
EA0055	ITEMS LESS THAN $2.0M (MISC-AMMO)	10.2	12.4	7.3	9.8
EA0650	SPARES AND REPAIR PARTS	0.0	1.2	1.0	2.5
EA0575	AMMUNITION PECULIAR EQUIPMENT	4.9	6.2	8.9	8.9
E64500	NITROGUANIDINE (LB)	23.8	23.0	12.8	9.2
EA0535	WAR RESER STOCKPIL(EXPL/PROPELLANT)	0.0	0.0	35.0	35.0
EA8000	AMMO 9WW/ELT	1.6	1.6	2.9	2.8
	HOST NATION SUPPORT (AMMO)	0.0	0.0	0.0	29.0
	TOTAL MISCELLANEOUS	62.5	66.6	94.3	123.2
	PRODUCTION BASE SUPPORT				
EP1000	PROVISION OF INDUSTRIAL FACILITIES	262.6	135.9	133.0	246.0
EA0054	COMPONENTS FOR PROVE-OUT	13.3	8.6	16.2	14.3
EP2000	LAYAWAY OF INDUSTRIAL FACILITIES	17.5	22.5	19.4	19.4
EP4000	JEFFERSON PROVING GRD MODERNIZATION	1.9	2.2	0.0	1.0
EP4100	CHEMICAL DEMILITARIZATION PROGRAM	77.3	0.0	0.0	0.0
EP1220	MODERNIZATION PROJECTS	98.0	186.0	0.0	0.0
	TOTAL PRODUCTION BASE SUPPORT	470.6	355.2	168.6	280.7
	TOTAL AMMUNITION PROCUREMENT	2,335.3	2,127.2	2,194.3	2,194.8

OTHER PROCUREMENT

SSN	ITEM NOMENCLATURE	FY86	FY87	FY88	FY89
	TACTICAL VEHICLES				
DA0100	TACTICAL TRAILERS/DOLLY SETS	29.7	26.7	42.4	43.1
D15201	MOTORCYCLE,GED, 2W,ROUGH TERRAIN	1.9	4.9	7.6	2.0
D01500	SEMITRAILER BB/CONT 22 1/2T M871 C/S	0.0	0.0	10.3	25.8
D01600	SEMITRAILER BB/CONT 34T M872 C/S	3.2	6.3	0.0	2.1
D01000	SEMITRAILER, LB, 12T M270A1-M269A1	6.8	0.0	0.0	0.0
D00700	SEMITRAILER, LOW BED, 40T M870 (C/S)	5.9	1.9	6.8	6.6
D02400	SEMITRAILER, LOW BED HET, XM1000	0.0	0.0	7.9	25.5
D02300	SEMITRAILER, TANK, 5000G	22.3	8.7	6.4	21.5
D02700	SEMITRAILER, TANK, 7500G, BULKHAUL	0.0	7.3	11.0	10.2
D03200	SEMITRAILER,VAN ELEC 6T 2W M373A2	0.0	0.0	0.0	6.0
D04800	SEMITRAILER,VAN SUPPLY 12T,2W,M129A2C	0.0	3.9	0.0	0.0
D15400	HI MOB MULT-PUR WHL VEH(HMMWV)(MYP)	290.4	322.5	109.3	158.4
D19000	SMALL UNIT SUPPORT VEHICLE (SUSV)	5.3	0.0	38.0	7.1
D14000	TRUCK, 5T, 6X6, ABT (MYP)	142.0	0.0	280.4	281.4
D16200	TRUCK, 10T, 8X8, ABT (MYP)	111.2	220.2	131.3	0.0
D15900	TRUCK, TRACTOR, LINE HAUL, M915A1	0.0	0.0	40.7	23.2
D10100	TRUCK, TRACTOR, HET, (C/S)	0.0	0.0	13.2	55.0
DA0925	MODS OF IN-SERVICE EQUIP	10.1	3.7	2.0	.1
G38900	SHOP EQUIPMENT, AUTO MAINT & REPAIR	.9	2.5	1.2	1.9
DL5110	ITEMS LESS THAN $2.0M (TAC VEH)	1.9	1.9	1.9	.6
	TOTAL TACTICAL VEHICLES	631.5	610.5	710.4	670.5
	NON-TACTICAL VEHICLES				
D23000	PASSENGER CARRYING VEHICLES	11.8	8.4	11.6	10.1
D24850	GENERAL PURPOSE VEHICLES	29.8	15.6	13.4	15.9
D25500	TRUCK, CARGO PICKUP, 4X2	11.6	0.0	4.0	5.9
D26300	TRUCK, CARRYALL	3.9	0.0	3.6	7.1
D25000	SPECIAL PURPOSE VEHICLES	18.6	4.7	7.2	16.0
	TOTAL NON-TACTICAL VEHILCES	75.7	28.7	39.8	55.0
	SUPPORT EQUIPMENT AND FACILITIES				
DA0350	SPARES AND REPAIR PARTS	127.9	134.6	118.6	126.5
DA0400	PRODUCTION BASE SUPPORT (TAC)	0.0	0.0	1.8	.7
	TOTAL SUPPORT EQUIPMENT AND FACILITIES	127.9	134.6	120.4	127.2
	TELECOM EQUIPMENT-READINESS COMMAND				
BB5777	JCSE EQUIPMENT (USREDCOM)	.3	1.2	3.7	3.1
BB2000	CLASSIFIED PROJECT 9WW	16.6	8.8	9.7	7.6
	TOTAL READINESS COMMAND	16.9	10.0	13.4	10.7
	TELECOM EQUIPMENT-JOINT TACTICAL COMMUNICATIONS				
BA1010	TRITAC EQUIPMENT	0.0	0.0	183.5	156.4
BA1055	MOD RCRD TFC TERM (MRTT)	22.5	0.0	0.0	0.0
BA1050	DIG GROUP MULTIPLEXER (DGM)	16.5	0.0	0.0	0.0
BA1045	RPTR/TERM ASSMBLGS	14.7	19.3	0.0	0.0
BA1040	RADIO TERMINALS AN/TRC-170	27.0	31.4	0.0	0.0
BA1035	MAINTENANCE SYSTEM AN/ARM-164	0.0	3.2	0.0	0.0
BA1030	UNIT LEVEL SWITCHES	10.0	0.0	0.0	0.0
B69100	COM SYS CON EL AN/TYQ-16	25.0	22.9	0.0	0.0
B50400	DIG NSEC VTER TA-954	3.8	0.0	0.0	0.0
B72300	ANDVT-TAC TERM, CV-3591	6.2	3.8	0.0	0.0
BB1610	MOB SUBSCRIBER EQUIP	335.3	903.7	1019.8	995.7
BB1600	MOD OF IN-SVC EQ (TRI-TAC)	15.8	9.6	12.4	23.1
	TOTAL JOINT TACTICAL COM	476.8	993.9	1,215.7	1,175.2
	TELECOM EQUIPMENT-COMBAT SUPPORT COMMUNICATIONS				
BA0027	COMM SYS (HTLD)	8.1	0.0	0.0	0.0
BO0500	SINCGARS	96.2	0.0	23.5	343.5
B13300	HAND CRANK GENERATOR, G-76	0.0	2.4	0.0	0.0
BU0055	RADIO MODS	33.9	3.9	11.7	0.0
Z15700	OPTICAL LONG HAUL TRANS SYS	0.0	9.0	9.9	10.4
B10500	PWR SUPPLY PP-6148/U	.8	4.0	2.2	0.0
B05300	RADIO SET AN/PRC-70	.2	0.0	0.0	0.0
BC2200	SOF MOD RADIOS	0.0	0.0	2.5	7.3
B45500	ANTENNA GROUP OE-254	2.0	6.3	5.0	0.0
B02600	SMALL UNIT TRANS AN/PRC-68	2.3	0.0	0.0	0.0
W18300	SMALL UNIT TRANSCEIVER	0.0	3.6	4.7	4.8
B76000	TELETYPEWRITER TERMINAL AN/UGC-74	2.5	0.0	0.0	0.0

OTHER PROCUREMENT

SSN	ITEM NOMENCLATURE	FY86	FY87	FY88	FY89
BB1550	MOD OF IN SVC EQUIP (CSC)	19.2	18.9	1.0	6.3
BZ8250	SWASIA COMM INFRASTRUCTURE	15.0	14.5	31.5	21.5
BL5220	ITEMS LESS THAN $2.0M (CSC-C-E)	11.8	5.7	6.5	4.2
BC2150	SPEC OPS COMM SUP ELMT	13.3	14.7	0.0	0.0
	TOTAL COMBAT SUPPORT COMMUNICATIONS	205.3	83.0	98.5	398.0
	TELECOM EQUIP-STARCOM NON-DCS				
BU3770	AR TELECOM AUTO PR (ATCAP)	4.7	3.1	5.4	5.6
BU4160	C-E FACILITIES/PROJECTS	8.2	4.6	4.7	3.9
BU4000	SOUTHCOM C3 UPGRADE	11.4	11.3	8.1	0.0
BD3100	ELECTROMAG COMP PROG (EMCP)	.6	.5	0.0	0.0
	TOTAL STARCOM NON-DCS	24.9	19.5	18.2	9.5
	LONG-HAUL COMMUNICATIONS (DCS)				
BU0200	AUTODIN (DCS)	4.5	0.0	0.0	0.0
BU0300	DEFENSE DATA NETWORK (DDN)	6.2	0.0	0.0	0.0
BU3800	TRANSMISSION MEDIA (EUCOM)	13.3	10.8	0.0	0.0
BU3850	TRANSMISSION MEDIA (PACOM)	17.1	15.3	0.0	0.0
BU3610	WW TECH CON IMP PR (WWTCIP)	5.0	2.6	0.0	0.0
	TOTAL DCS	46.1	28.7	0.0	0.0
	TELECOMM EQUIP-SATCOM-GROUND ENVIRONMENT				
BB8501	DIGITAL EQUIPMENT (DSCS)	33.9	28.4	14.3	13.1
BB8504	INTERCONNECT FACILITY (DSCS)	8.2	2.1	3.8	3.8
BA8300	JAM RESISTANT SECURE COM (JRSC)	18.6	9.0	8.9	6.7
BB8507	MED SAT TERM AN/GSC	59.1	0.0	0.0	0.0
BZ3500	SPRD SPEC MUL ACC(DSCS)	11.6	0.0	0.0	0.0
BB8509	DSCS OPERATIONS CONTROL SYS (DOCS)	29.2	71.6	63.3	57.9
BB8416	MOD IN-SERVICE EQUIPMENT (DSCS)	11.0	0.0	1.3	6.6
BB8416	MPK SAT UHF TERM, AN/PSC-3	3.7	4.9	4.1	1.3
K45900	VEH SAT UHF TERM, AN/VSC-7	1.3	1.4	1.1	.6
K23700	SINGLE CHANNEL OBJ TACT TERM (SCOTT)	0.0	0.0	1.2	55.1
BB8417	MOD IN-SVC EQUIP (TAC SAT)	54.4	6.8	3.4	3.4
	TOTAL SATCOM GROUND ENVIRONMENT	231.0	124.2	101.4	148.5
	TELECOM EQUIP-EUCOM C3 SYSTEM				
BB8422	EUCOM C3 (NWS)	93.4	66.4	16.2	0.0
BB8430	PACOM C3 (NWS)	0.0	10.7	19.4	0.0
BA8200	EUCOM ALTERNATE SPT HQ (ASH)	6.7	3.7	0.0	0.0
BA8250	USAREUR C2 PROJECT	0.0	7.5	9.1	6.8
	TOTAL EUCOM C3 SYSTEM	100.1	88.3	44.7	6.8
	TELECOM EQUIP-COMSEC EQUIPMENT				
T68000	AUTO KEY DC KGX-93/TSEC	0.0	1.0	1.1	1.0
TA0400	IFF COMSEC	0.0	0.0	4.5	4.8
T67500	TRUNK ENCRYPTION DEVICES	0.0	0,0	10.0	12.1
TA0600	MINITERM KY-99	0.0	0.0	0.0	2.2
Z16800	BATTLEFIELD ELECT COEI SYS (BECS)	0.0	0.0	0.0	26.3
BZ8950	SECURE VOICE IMPROVEMENT PRG(COMSEC)	21.3	13.3	19.0	29.9
T53000	LOOP KEY GEN TSEC/KG-82	.9	0.0	0.0	0.0
T54000	DED LOOP ENCRYP DEV KG-84	39.0	21.5	16.4	21.3
T67500	TNK ENCRYP TSEC/KG-93	2.1	2.0	0.0	0.0
T02100	TSEC/KG-94	17.0	11.9	0.0	0.0
T54500	DIG SUB VOICE TSEC/KY-68	2.0	0.0	0.0	0.0
T06200	KEY GENERATOR, TSEC/KG-87	0.0	1.7	.7	.3
T06400	COMSEC MODULE, TSEC/KGV-13	0.0	19.3	17.8	6.2
T99500	FREQ MODULE, KGV-10/TSEC	5.5	0.0	6.5	16.4
T50000	SPEECH SECURE EQ TSEC/KY-57	17.0	0.0	0.0	0.0
BQ0200	TEMPEST (COMSEC)	1.0	.7	1.2	1.7
T01600	ADDS COMSEC	0.0	.6	0.0	1.9
T03200	TSEC/KGV-11/SECURE MODULE	2.9	0.0	.4	1.4
T92500	BATSON II, TSEC/CI-14	10.5	0.0	0.0	0.0
BL5264	ITEMS LESS THAN $2.0M (COMSEC)	8.3	10.4	4.3	3.4
	TOTAL COMSEC EQUIP	127.5	82.4	81.9	128.9
	TELECOMM EQUIP-BASE COMMUNICATIONS				
BB8700	INFO SYSTEMS CONUS/WEST HEMISPHERE	42.6	34.7	27.7	15.1
BU4165	LOCAL ARE NETWORK (LAN)	0.0	1.6	0.0	0.0
BB8800	INFO SYSTEMS EUCOM	10.4	7.7	8.7	4.9

OTHER PROCUREMENT

SSN	ITEM NOMENCLATURE	FY86	FY87	FY88	FY89
BB8900	INFO SYSTEMS PACOM	6.3	1.6	8.0	8.0
BU1130	DA COMD + CON SYS (DACCS)	7.8	0.0	0.0	0.0
BU1200	ARMY OPNS CTR	.1	4.2	0.0	0.0
BQ0100	PENTAGON TELECOM CTR (PTC)	8.8	4.0	0.0	0.0
	TOTAL BASE COMMUNICATIONS	76.0	53.8	44.4	28.0
	TMDE FOR TELECOMMUNICATIONS				
BZ5269	CALIBRATION EQUIPMENT	0.0	0.0	21.3	24.2
BZ5270	TMDE MODERNIZATION	35.5	16.4	15.0	20.9
	TOTAL TMDE	35.5	16.4	36.3	45.1
	OTHER ELECT SYSTEMS				
BB2050	4TH PSYOP GROUP	0.0	12.1	12.1	11.2
K28800	ALL SOURCE ANALYSIS SYS(ASAS)-TIARA	0.0	93.5	53.8	0.0
V15900	SINGLE SOURCE PROCESSOR	0.0	0.0	3.8	0.0
VA7900	REAR ECHELON COMINT SYSTEM	0.0	0.0	27.7	0.0
V29600	COMMANDERS TACTICAL TERMINAL	0.0	14.4	20.4	0.0
V07300	TRAILBLAZER	18.2	11.8	0.0	0.0
BZ7315	TAC ELEC SURV SYS	15.0	3.9	3.4	4.7
K06800	MANPACK RADIO DF SYSTEM	.7	5.5	5.2	0.0
V07800	TEAM PACK	5.7	0.0	0.0	0.0
BL5278	ITEMS LESS THAN $2.0M (INT-SPT-C-E)	5.3	.9	5.9	.7
BZ9750	MOD IN SVCEQU (INT SPT) TIARA	17.7	36.6	29.1	41.7
BB6010	FT DEVENS TRAINING SUPPORT	.4	.4	.5	.5
BA0326	TROJAN	8.8	23.9	25.4	0.0
	TOTAL OTHER	71.8	203.0	187.3	58.8
	GENERAL DEFENSE INTELLIGENE PROGRAM				
BD3900	INTELL DATA HANDLING SYS (IDHS)	23.0	6.7	25.0	0.0
BZ8920	TECH RECON AND SURV SYS (TECRAS)	7.5	9.9	4.7	0.0
BL5282	ITEMS LESS THAN $2.0M (FCI/S&IA-C-E)	0.0	1.1	1.8	0.0
BL5283	ITEMS LESS THAN $2.0M (GDIP-C-E)	4.4	9.1	11.1	0.0
	TOTAL GDIP	34.9	26.8	42.6	0.0
	OTHER EQUIPT AUTO DATA PROCESSING				
BD3970	STARNET/VIABLE	24.2	40.6	0.0	29.0
B78400	BATTERY COMPUTER SYSTEM	16.8	10.7	0.0	0.0
BD3950	AMC INFORMATION PROCESSING EQUIP	18.8	1.9	18.5	38.7
B28600	ADV FIELD ARTILLERY TACT DATA SYS	24.3	0.0	77.7	78.7
BU1400	ARMY DATA DISTRIBUTION SYSTEM-ADDS	13.8	70.0	116.6	159.0
BZ9200	TRADOC AUTOMATION	0.0	3.6	2.3	.5
BZ9300	USAREUR TACTICAL AUTOMATION	2.1	1.9	0.0	0.0
BD3955	LIFE CYCLE SOFTWARE SUP (LCSS)	5.3	8.8	9.2	9.2
BE4150	ADPE FOR NON TAC MGT INFO SYS	41.1	38.5	0.0	0.0
BE4152	SUPERCOMPUTERS	0.0	22.2	27.4	0.0
BE4158	PROJECT 80X PHASE II	0.0	12.5	0.0	0.0
BE4157	TRANS OF PERS PROP	0.0	2.8	0.0	0.0
BE4159	EUSA-C3I INITIATIVES	0.0	0.0	0.0	8.6
BE4160	STD ARMY AUTO CONTRACT SY	0.0	6.6	0.0	0.0
BE4161	HQ AUTOMATION SYSTEMS	0.0	0.0	20.4	20.2
BE4162	IPE STAIRS	0.0	0.0	0.0	8.3
BE4163	MEDICAL AUTOMATION SYSTEMS	0.0	0.0	2.2	1.6
BE4164	PERSONNEL AUTOMATION SYSTEMS	0.0	0.0	24.6	18.2
BE4165	TRAINING AUTOMATION SYSTEMS	0.0	0.0	2.4	0.0
BE4166	LOGISTICS AUTOMATION SYSTEMS	0.0	0.0	9.5	14.4
BE4167	RESERVE COMPONENT AUTOMATION SYSTEMS	0.0	25.2	23.1	34.7
B83900	FIRE SUPPORT TEAM·DIGITAL MESSAGE	13.5	0.0	0.0	0.0
BZ9851	FORWARD ENTRY DEVICE	0.0	11.6	22.8	22.9
BE4200	NON-CENTRALLY MANAGED ITEMS	101.1	0.0	0.0	0.0
BA9300	MANEUVER CNTRL SYSTEM	58.2	55.2	96.1	9.7
BC1000	MOD IN SVC COMD/CONTROL (C2)	.2	0.0	0.0	0.0
BZ9350	CORPS/THEATER ADP SVC CTR (CTASC)	0.0	9.4	17.5	17.6
B62000	TACT ARMY CMBT COMPT SY (TACCS)	42.3	38.3	30.8	1.3
AD5050	FAAD C2I	0.0	0.0	76.3	63.1
AD5051	POSITIVE HOSTILE ID	0.0	0.0	0.0	14.5
K99200	COMPUTER BALLISTICS: MORTAR XM-23	5.7	0.0	0.0	0.0
BZ8889	CSS LOG APL AUTO MARK/RD SYM(LOG MAR)	10.0	11.1	21.2	19.5
BE4100	WWMCCS INFORMATION SYSTEM (WIS)	14.8	35.1	23.3	33.7

OTHER PROCUREMENT

SSN	ITEM NOMENCLATURE	FY86	FY87	FY88	FY89
BZ8888	UNIT LEVEL COMPUTER (ULC)	5.2	0.0	0.0	0.0
	TOTAL AUTOMATIC DATA PROCESSING	397.4	406.1	621.9	603.4
	AUDIO VISUAL				
BZ8480	AFRTS (AUDIO VISUAL)	8.4	7.8	5.0	6.3
BE1000	DIG STRG & RTRVL ENG DATA SY (DSREDS)	23.0	0.0	0.0	0.0
BL5289	ITEMS LESS THAN $2.0M (A/V - C-E)	10.7	6.8	9.1	10.2
BL5290	TACTICAL ELECTRONIC NEWS GATHERING EQUIP	0.0	0.0	3.0	2.0
	TOTAL AUDIO VISUAL	42.1	14.6	17.1	18.5
	OTHER ELECT SYS/EQUIP-ELECTRONIC WARFARE				
V02300	COUNTERMEASURES SET AN/TLQ-17A	5.4	0.0	0.0	0.0
V07200	TACJAM, AN/MLQ-34	8.4	32.0	0.0	0.0
VV0255	TACTICAL DECEPTION (TAC-D)	6.1	0.0	4.6	0.0
BA6100	MOD IN SVC EQUIP (EW)	11.4	8.1	2.8	11.3
BL5292	ITEMS LESS THAN $2.0M (EW-C-E)	1.7	1.0	.8	.9
	TOTAL ELECTRONIC WARFARE	33.0	41.1	8.2	12.2
	OTHER ELECT SYS/EQUIP-TACTICAL ELECTRONICS				
BB1100	BATTERY CHARGER PP-7286/U	.1	2.9	1.9	0.0
K02900	POWER SUPPLY, PP-6224	1.9	3.2	3.2	3.2
B92400	COMPUTER/INDICATOR, CP-696/PD	4.4	3.6	3.8	6.4
K27800	METEROLOGICAL DATA SYS (FAMAS)	31.3	0.0	1.1	8.4
B92000	GND/VEH LASER LOC DESIGNAT'R (G/VLLD)	39.7	0.0	0.0	0.0
B81200	HAND HELD LASER RANGEFINDER AN/GVS-5	0.0	6.6	0.0	0.0
BZ7900	PHYSICAL SECURITY EQUIPMENT	15.7	20.2	5.8	16.3
BZ7900	INTRUSION DETECTION DEVICES	0.0	0.0	5.3	10.3
K47800	NAVSTAR GLOBAL POSITIONING SYSTEM	9.2	5.0	23.8	29.8
M75700	POS/AZIMUTH DETERMINING SYS (PADS)	17.7	13.1	21.7	19.1
KA3500	NIGHT VISION GOGGLES	61.5	63.2	138.1	138.1
K35000	AIMING LIGHT INFRARED, AN/PAQ-4	0.0	0.0	1.5	2.0
K41500	NIGHT VISION SIGHT INDIV WPN N/PVS-4	9.5	10.0	14.5	14.1
B26200	POS LOC REPORTING SYS (PLRS) (MYP)	46.2	0.0	0.0	0.0
B43300	RADIAC SET AN/VDR-2	2.6	3.9	5.1	6.1
BA9200	REMBASS-TIARA	20.4	0.0	0.0	0.0
A02900	RPV TA/DESGN AERIAL RECON SYS(TADARS)	27.9	49.0	179.4	196.3
C98000	UNMANNED AERIAL VEHICLE (UAV) FAMILY	0.0	0.0	42.4	46.0
B47100	MULTIFUNCTION RADAR TRANSPONDER BEACON	0.0	0.0	4.7	4.4
BA1080	JOINT STARS (ARMY)	0.0	16.8	36.9	81.2
KA4200	ELECTRONIC MAINTENANCE SHOPS	0.0	4.2	11.6	3.7
K71700	TEST SET, RADAR, AN/TPM-25	0.0	0.0	2.5	0.0
BZ7325	MOD OF IN SVC EQUIP (TAC EL)	12.8	37.2	32.5	31.9
BL5295	ITEMS LESS THAN $2.0M (TACT ELEC-C-E)	13.1	8.4	6.4	6.4
	TOTAL TACTICAL ELECTRONICS	314.0	247.3	542.2	623.7
	TMDE FOR TACTICAL ELECTRONICS				
K07900	TEST STA, ELEC EQUIP, AN/USM-410	6.4	0.0	0.0	0.0
KA4000	INTERMEDIATE FORWARD TEST EQUIP	0.0	0.0	27.6	57.1
M87001	TMDE FOR STE/ICE	1.0	6.3	2.2	1.8
M87003	CORE ELECTRONIC AUTO TEST (STE-X)	0.0	1.0	2.0	2.7
	TOTAL TMDE FOR TAC ELECTRONICS	7.4	7.3	31.8	61.6
	OTHER ELECT SYS/EQUIP-SUPPORT EQUIP AND FACILITIES				
BA9500	SP/REP PARTS (TELECOMM-C-E)	189.1	168.0	162.4	132.6
BA9600	SPARES AND REPAIR PARTS	3.0	10.1	9.3	8.6
BA9700	SP/REP PART (COMSEC)	180.3	204.0	315.9	301.7
BA9800	WAR RESERVE SPARES	17.4	0.0	0.0	0.0
BF5500	SPECIAL PROGRAMS	99.3	106.0	209.2	81.3
BB9050	QUICK RETURN ON INVEST(QRIP) PGM	.6	0.0	0.0	0.0
BB9000	PRODUCTIVITY INVESTMENT FUNDING	38.6	30.2	27.2	19.7
BB9051	PROD ENHANCING CAP INVEST PRG (PECIP)	4.9	21.2	8.8	8.6
BF5400	PRODUCTION BASE SUPPORT (C-E)	4.6	10.9	5.2	9.6
	TOTAL SUPPORT EQUIPMENT & FACILITIES	537.8	550.4	738.0	562.1
	CHEMICAL DEFENSE EQUIPMENT				
M96800	REMOTE SENSING CHEMICAL ALARM (XM21)	0.0	0.0	0.0	4.3
M96200	SIM DET CHEM AGENT AUTO ALARM XM81	4.5	0.0	0.0	0.0
M67400	DECONTAMINATE APP PWR DR LT WT XM17	6.1	3.9	3.9	7.4

OTHER PROCUREMENT

SSN	ITEM NOMENCLATURE	FY86	FY87	FY88	FY89
G45601	NONAQUEOUS EQUIP DECON SYSTEM	0.0	0.0	0.0	2.0
MA5000	MASK, PROTECTIVE, NBC	28.7	0.0	51.0	50.7
S02200	CHEMICAL AGENT MONITOR	18.4	0.0	19.3	9.8
M97400	SIMP COLL PROT EQUIP XM20	3.7	2.7	4.2	4.7
M98300	MODULAR/COLL PROT EQUIP FOR VV & S	1.1	0.0	0.0	0.0
M99104	GEN SET,SMOKE,MECH: PUL JET, XM157	4.0	9.2	0.0	0.0
	TOTAL CHEMICAL DEFENSE	66.5	15.8	78.4	78.9
	BRIDGING EQUIPMENT				
M23600	RIBBON BRIDGE ERECTION BOAT	25.2	19.2	0.6	0.0
M26600	BRIDGE, FLOAT RIBBON, INTERIOR BAY	5.7	7.2	.2	0.0
M26700	BRIDGE, FLOAT RIBBON RAMP	3.4	3.2	.2	0.0
M26800	BRIDGE, FLOAT RIBBON, TRANSPORTER	18.5	18.2	10.9	0.0
R05500	LAUNCHER, LIGHT ASSULT BRIDGE	0.0	0.0	0.0	3.2
R05400	LIGHT ASSULT BRIDGE	0.0	0.0	0.0	3.2
ML5315	ITEMS LESS THAN $2.0M (BRIDGING)	.9	1.3	.1	.7
	TOTAL BRIDGING EQUIPMENT	53.7	49.1	12.0	7.1
	ENGINEER NON-CONSTRUCTION EQUIPMENT				
G27000	GEMSS AUX MINE DISPENSER XM138	.4	2.9	0.0	0.0
G39100	DISPENSER MINE XM139	0.0	1.7	0.0	5.0
G22500	MIXER/PUMPER UNIT (MPU) TEXS	0.0	0.0	8.9	12.8
X00700	MARKING SYS, CLEAR LANE	3.5	3.2	1.3	2.9
M15300	DET SET,MINE,MET/NON-MET,AN/PRS-8	0.0	4.9	4.8	3.8
RO6100	MINE PLOW	0.0	5.5	10.9	18.4
X00600	MINE CLEARING ROLLER	3.3	3.7	3.1	7.7
G00501	REMOTE CONTROL UNIT (MOPMS)	4.4	9.5	9.3	0.0
R20000	SURVEY SET DIST MEASURING INFRARED	0.0	2.8	0.0	0.0
M05900	M-9 ARMORED CMBT EARTHMOVER(ACE)(MYP)	39.1	20.3	66.0	62.0
ML5320	ITEMS LESS THAN $2.0M(ENG NON-CONST)	1.4	.9	1.7	1.3
	TOTAL ENGR NON-CONSTRUCTION EQUIP	52.1	55.4	106.0	113.9
	COMBAT SERVICE SUPPORT EQUIPMENT				
MF9300	AIR COND VARIOUS SIZE/CAPACITIES	22.2	31.5	15.0	18.8
M86600	FIELD KITCHEN, MOBILE, TRL MTD	5.2	13.1	15.5	15.8
M86900	MODULAR FIELD KITCHEN	0.0	0.0	4.2	7.0
MA9500	DIVING EQUIPMENT	.6	1.8	3.8	2.9
MA9600	FIRETRUCKS	18.1	16.0	13.2	13.6
M90900	HEATER DUCT TYPE	0.0	0.0	3.0	2.0
M87600	LAUNDRY UNIT/TRL MTD	0.0	7.1	5.8	5.9
MB2000	TAG PRINTING AND BINDING EQUIPMENT	5.1	4.3	4.6	1.0
M75000	PRINT PLANT, SW TRANSPORTABLE	0.0	0.0	2.4	0.0
ML5325	ITEMS LESS THAN $2.0M (CSS-EQ)	10.9	10.7	6.9	20.4
MA8100	MOD OF IN SVC EQUIPMENT (CSE)	1.6	8.7	4.9	3.2
	TOTAL COMBAT SERVICE SUPPORT EQUIPMENT	63.7	93.2	79.3	90.6
	PETROLEUM EQUIPMENT				
M19000	TANK ASSEMBLY FAB COLL POS 50000G	3.7	4.6	6.0	3.7
M64000	FORWARD AREA REFUELING EQUIPMENT	0.0	2.8	0.0	0.0
M64900	TANK ASSEMBLY FAB COLLAPSIBLE 10K G	5.4	6.3	4.2	5.6
R21400	TANK ASSEMBLY FAB COLL, 20K GAL POL	0.0	6.3	0.0	0.0
M62300	TANK/PUMP UNIT LIQ DISP F/TRK MNT	0.0	1.0	4.4	5.1
M73300	LAB, PETROLEUM, SEMI-TRLR MTD	0.0	3.2	1.7	1.6
M63900	PUMP ASBLY LIQ GAS WHL 4 IN OUT 350GPM	4.0	12.0	2.8	0.0
MA5120	SWA PETROLEUM DISTRIBUTION	37.1	36.1	41.8	39.3
ML5330	ITEMS LESS THAN $2.0M (POL)	4.2	6.7	5.0	1.3
	TOTAL PETROLEUM EQUIPMENT	54.4	79.0	65.9	56.6
	WATER EQUIPMENT				
M16600	WTR PUR UNIT REV OS 3000 GPH (ROWPU)	12.4	33.9	20.3	20.0
M18000	WATER PUR UNIT, REV OSMOSIS, 600GPH	16.2	12.0	11.5	0.0
M27400	TACTICAL WATER DISTR SYS	13.6	0.0	9.2	4.5
M15000	TANK, FAB,COLL,3K GAL WATER (ONION)	0.0	2.9	0.0	2.4
M15700	SMALL MOBILE WATER CHILLER (SMWC)	.8	1.5	0.0	0.0
M15900	PUMP CENTRIFUGAL 65GPM	3.4	2.1	1.6	1.6
ML5335	ITEMS LESS THAN $2.0M (WATER EQ)	5.3	2.5	3.9	3.1
	TOTAL WATER EQUIPMENT	51.7	54.9	46.5	31.6

OTHER PROCUREMENT

SSN	ITEM NOMENCLATURE	FY86	FY87	FY88	FY89
	MEDICAL EQUIPMENT				
MB9700	DEPLOYABLE MEDICAL SYSTEM (DMS)	98.4	36.6	82.8	78.2
MA8045	CBT SUP EQUIP MEDICAL	82.8	21.5	45.0	38.6
MA9900	MEDICAL SUPPORT EQUIPMENT	79.5	70.8	60.0	65.2
	TOTAL MEDICAL EQUIPMENT	260.7	128.9	187.8	182.0
	MAINTENANCE EQUIPMENT				
M61500	SHOP EQ CONT MAINT TRK MTD ADV PROC	25.6	0.0	0.0	0.0
M62700	WELDING SHOP, TRAILER MTD	8.6	9.7	0.0	4.4
M82900	CLOTHING REPAIR SHOP TRL MTD	0.0	0.0	0.0	3.0
M61600	SHOP EQ ELECTRICAL RPR SEMI-TRL MTD	12.9	14.5	9.6	10.7
S60000	STEAM CLEANER	0.0	5.0	2.0	0.0
G31100	SHOP EQUIP, CANVAS AND GLASS SHELTER MTD	0.0	0.0	5.2	0.0
M63300	E WELD MACH ELEC ARC 350AMP (CC-CP)	0.0	5.7	0.0	0.0
MA0460	CALIBRATION SET SUPPORT	7.3	11.7	0.0	0.0
ML5345	ITEMS LESS THAN $2.0M (MAINT EQ)	9.2	11.5	2.8	1.3
	TOTAL MAINTENANCE EQUIPMENT	63.6	58.1	19.6	19.4
	CONSTRUCTION EQUIPMENT				
M03100	DISTRIBUTED WATER SP MIN 2500 GAL	0.0	0.0	5.6	0.0
R03600	DIST WATER, 6000G, SEMI-TRL MTD	0.0	0.0	3.4	0.0
M06100	TRACTOR FULL TRACKED LOW SPEED DD MED	24.8	45.0	0.0	0.0
R04400	TRACTOR CRAWLER T-11	0.0	0.0	7.0	0.0
R04800	SMALL EMPLACEMENT EXCAVATOR (SEE)	31.0	22.9	38.6	36.6
RO5000	CRANE, WHL MTD, HYDRAULIC 7 1/2 TON	0.0	0.0	0.0	13.8
MA8300	MODS OF IN SVC EQUIP (CONST EQUIP)	0.0	.1	.2	.2
ML5350	ITEMS LESS THAN $2.0M (CONST EQUIP)	9.3	.7	12.8	15.3
	TOTAL CONSTRUCTION EQUIPMENT	65.1	68.7	67.6	65.9
	RAIL/FLOAT CONTAINERIZATION EQUIPMENT				
M34200	LANDING, CRAFT, UTILITY	21.7	28.5	24.6	46.7
M44500	TUG HARBOR INLAND WATERWAYS	0.0	0.0	8.4	4.9
M44600	TUG INLAND AND COASTAL WATERWAYS	0.0	25.1	11.1	10.9
R09800	RO/RO DISCHARGE PLATFORM	7.2	0.0	0.0	0.0
R97500	CAUSEWAY SYSTEMS	15.2	27.4	22.0	3.0
MA4029	ARAPAHO	4.7	0.0	0.0	0.0
M39500	RAILWAY CAR, TANK, POL, 20000G	0.0	9.8	0.0	0.0
MA8950	MOD OF IN-SVC EQU (FLOAT/RAIL)	.4	4.8	4.3	4.2
ML5355	ITEMS LESS THAN $2.0M (FLOAT/RAIL)	3.8	1.0	3.4	3.0
	TOTAL CONTAINERIZATION EQUIPMENT	53.0	96.6	73.8	72.7
	GENERATORS				
MA9800	GEN AND ASSOCIATED EQUIP	75.1	100.6	44.2	42.8
	MATERIEL HANDLING EQUIPMENT				
X50000	TRUCK, FORK LIFT, CBD, PT, 4000 LB	0.0	12.2	8.4	0.0
X51100	TRUCK, FORK LIFT, CBD, PT, 6000 LB	9.1	11.7	0.0	0.0
M48900	TRUCK, FORKLIFT,DE,PT,RT,6000 LB	0.0	20.4	18.2	21.5
M49300	TRUCK, FORKLIFT,ELEC,SRT,6000 LB	2.5	0.0	0.0	0.0
M41300	TRUCK, FORKLIFT,DE,PT,RT,4000 LB	0.0	0.0	3.8	0.0
M49200	TRUCK, FORKLIFT,ELEC,SRT 4000 LB	8.4	1.7	0.0	0.0
X00900	65 TON CRANE	5.9	30.0	34.6	11.0
ML5365	ITEMS LESS THAN $2.0M (MHE)	4.1	2.4	2.7	1.2
	TOTAL MATERIEL HANDLING EQUIPMENT	30.0	78.4	67.7	33.7
	OTHER SUPPORT EQIPMENT				
MA0350	SPARES AND REPAIR PARTS (OTHER)	23.1	50.4	48.3	54.1
MB2100	AREA ORIENTED DEPOT UPGRADE	79.8	0.0	0.0	0.0
MA5130	VALUE ENGINEERING	.6	1.0	0.0	0.0
MA5730	PROJECT RESHAPE (HQ DARCOM)	5.5	0.0	0.0	0.0
MA0450	PRODUCTION BASE SUPPORT (OTHER)	7.5	33.4	7.0	8.0
MA5600	OSD PRODUCTIVITY INVESTMENT FUNDING	0.0	4.9	3.4	7.2
MA6700	SPECIAL EQUIPMENT FOR USER TESTING	20.5	13.3	17.2	14.8
MA5175	HOST NATION SUPPORT - EUROPE	38.8	41.9	40.3	57.4
MA6600	NATIONAL TRAINING CTR SUP	12.6	10.8	34.6	25.7
MA1300	SWA STAGING BASES	2.7	0.0	0.0	0.0
NA0100	TRAINING DEVICES, NONSYSTEM	167.3	177.3	137.9	157.1
MB7100	NON-CENTRALLY MANAGED ITEMS	0.0	77.2	19.8	20.5
	TOTAL OTHER SUPPORT EQUIPMENT	358.4	410.2	308.5	344.8
TOTAL OTHER PROCUREMENT		4,861.7	5,058.9	5,870.9	6,030.3

Honorable Jay R. Sculley

Assistant Secretary of the Army for Research, Development, and Acquisition

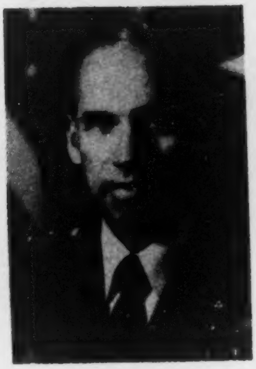
Dr. Jay R. Sculley, the Assistant Secretary of the Army for Research, Development and Acquisition, took office on October 13, 1981.

As Assistant Secretary of the Army for Research, Development and Acquisition, Dr. Sculley is the Scientific Advisor to the Secretary of the Army and is responsible for Army wide policy development and oversight of research, development, test and evaluation programs and of materiel acquisition management, policies and procedures. He is also responsible for implementation of worldwide security assistance policies and international programs.

Dr. Sculley is a graduate of the Virginia Military Institute where he received a Bachelor of Science degree in Civil Engineering in 1962. Following graduation from VMI, he served as an officer in the U.S. Air Force and later was a design engineer with the Dupont Company before earning his MSE and Ph.D. at the Johns Hopkins University.

In 1970, Dr. Sculley joined the VMI faculty and served four years as an assistant professor of civil engineering before electing in 1974 to leave teaching and enter industry. He was General Manager of Corrugated Services, Inc., a Texas paper recycling company, for one year before returning to VMI in 1975. During his faculty years at VMI, he was actively involved in engineering research through the VMI Research Laboratories, Inc. He is the author of numerous papers and has been elected to Who's Who in Engineering. At the time of his appointment by President Reagan, he was Professor and Head of Civil Engineering, VMI's largest academic department. Since assuming his present position, Dr. Sculley has been instrumental in improving the management and cost discipline of major hardware acquisition programs. He directed the integration of technology base efforts throughout the Army and expanded the program for centers of excellence at American universities for Army sponsored research. He has also initiated programs to upgrade the training, development and utilization of people throughout the research, development and acquisition field.

Dr. Sculley is married to the former Peggy Lee Winkel of Baltimore. They have one daughter, Rebecca Lee.



Lieutenant General Louis C. Wagner, JR., USA Deputy Chief of Staff for Research, Development, and Acquistion Department of the Army

Lieutenant General Louis C. Wagner, Jr., born on 24 January 1932 in Jackson, Missouri, was graduated from the U.S. Military Academy in June 1954 and began his military career as a Second Lieutenant, Armor. General Wagner's early assignments included command positions with the 11th Airborne Division in the U.S. and Germany followed by an assignment to the 6th Armored Calvary. General Wagner also served two tours in Vietnam as an advisor for infantry and armor units, attended graduate school at the University of Illinois, and instructed at West Point for three years.

Key assignments in General Wagner's military career include command of a light airborne armored battalion at Fort Riley and Fort Bragg, command of the 1st Brigade, 3rd Armored Division, Germany and Commander of the U.S. Army Armor Center and Fort Knox. He was also assigned to the Office of the Chief of Staff, U.S. Army. Additional DA staff positions included Deputy Director, Materiel Plans and Programs and Director of Combat Support Systems, Office of the Deputy Chief of Staff for Research, Development and Acquisition. Prior to his current assignment he served as Assistant Deputy Chief of Staff for Operations and Plans for Force Development.

General Wagner's military education includes attendance at the Armor Basic and Advanced Courses, Ranger and Airborne Schools, U.S. Army Command and General Staff College and the Naval War College.

His military awards include the Distinguished Service Cross, Distinguished Service Medal, Silver Star, two awards of the Legion of Merit, Bronze Star Medal, Meritorious Service Medal, two awards of the Air Medal, three awards of the Army Commendation Medal, Purple Heart, Combat Infantryman Badge, Senior Parachutists Badge, Ranger Tab, and various foreign decorations.

General and Mrs. Wagner, the former Mary Judith Gifford of Webster Groves, Missouri, have three children—Susan, Stephen and Amy.

General Wagner assumed his duties as Deputy Chief of Staff for Research, Development and Acquisition on 1 August 1984 following his promotion to Lieutenant General. He has been nominated for promotion to the rank of General and assignment as the commander of the Army Materiel Command.

SUBMITTED QUESTIONS

Chairman Stennis. The written questions of committee members will be inserted in the record at this point.

[The following questions were not asked at the hearing, but were submitted to the Department for response subsequent to the hearing:]

QUESTIONS SUBMITTED BY CHAIRMAN STENNIS

ARMY AVIATION INVESTMENT BUDGET

QUESTION. General Wagner, in your testimony you imply that affordability concerns have caused you to curtail helicopter production, but your request for aviation research and procurement is about the same level as last year. Isn't it really true that you have traded off near term production of Apache and Black Hawk helicopters for development of the Light Helicopter Experimental (LHX)?

ANSWER. No. Within current funding restraints, the Army's budget request sufficiently provides for near term capability without sacrificing a critical long term modernization requirement in the form of LHX.

QUESTION. General RisCassi, are you concerned that the Army will not be producing as many Apache and Blackhawks as expected last year?

ANSWER. Yes. Resource constraints have resulted in reduced production quantities.

QUESTION. Do you agree with General Wagner's views on the trade-off between current production and LHX?

ANSWER. Yes.

LIGHT HELICOPTER EXPERIMENTAL (LHX)

QUESTION. General Wagner, your budget request includes $397 million for research and development for the LHX program in 1988 and $598 million in 1989. Altogether this program will cost more than $66 billion to buy 4,500 helicopters. Can you assure this Committee the progam is affordable considering budget constraints?

How can a $66 billion LHX program be affordable when you can't afford to modernize Scout helicopters in 1988 and build Apache helicopters in 1989?

ANSWER. Yes, the LHX program is affordable. We believe that affordability begins with capability and that the capability of LHX will be far superior to the current light fleet of UH-1, AH-1 and OH-58 aircraft. The question is not just affordability, but one of prioritization as well. There are systems within Army procurement that will be bought out by the time LHX goes into production. This will allow us to afford LHX.

ARMY HELICOPTER IMPROVEMENT PROGRAM (AHIP)

QUESTION. General Wagner, the Congress is reviewing a supplemental appropriation request of $194.3 million to pay Army soldiers. Considering your decision to cancel the Army Helicopter Improvement Program (AHIP) in 1988 before you buy all that you need, why shouldn't the Committee cancel it now and use that money to pay your soldiers?

ANSWER. The pay of soldiers is a stand-alone statutory requirement that must be satisfied regardless of the Army's other operational requirements. To penalize the Army by considering equipment trade-offs to pay soldiers due to fluctuations in foreign currency is not sound. The Army still has a firm operational requirement for 135 AHIPs. Our decision to terminate AHIP in FY 1988 was based on affordability. The initial reports from Ft. Sill training in the FAAO live-fire missions are superb. If the 36 AHIPs are not procured with the FY 1987 funding, forward deployed forces will lose either 24 or 30 AHIPs from the program we have designed with the 135 AHIPs.

ARMY AVIATION PRIORITIES

QUESTION. General Wagner, the budget deficit that we face will probably mean the Committee has to cut your aviation budget request. Is your top priority keeping LHX development on track or continuing to produce Blackhawk and Apache helicopters?

ANSWER. The answer to your question is yes, it is the Army's top priority to keep LHX development on track. The LHX program is critical to the Army's future to maintain technological superiority on tomorrow's battlefield. Under the present budget constraints, the Army has no option but to continue with this approach.

APACHE ATTACK HELICOPTERS (AH-64)

QUESTION. General Riscassi,the Army currently plans to procure only 593 Apache helicopters. I understand you need 1031. What plans do you have to fill this requirement and what portion of your Guard and Reserve requirement will not be filled?

ANSWER. Of the required 1031 AH-64's, 504 are for active, 270 are for ARNG, and 72 are for USAR heavy attack battalions. These aircraft are required for 28 active, 15 ARNG and 4 USAR battalions. With the buy of 593 AH-64's, 26 active and 3 ARNG battalions will receive the AH-64. That leaves 2 active, 12 ARNG and 4 USAR battalions that require AH-64's but will not receive them. These units will be resourced with the AH-1 Cobra.

QUESTION. General Wagner, according to current Army plans it appears there will be about a six year gap between production of the Apache and the new scout-attack version of the LXH. Can you tell us what you think the impact will be on the industrial base and skilled manpower for attack helicopter production.

Won't this six year production gap significantly add to the start-up of the next generation of helicopters?

Has this been included in LHX cost calculations?

ANSWER. There will be a significant negative impact on the industrial base. The Army would rather it not be this way, but given the current bugetary limitations, and Army priorities, it is unavoidable. No, the technology for LHX is sufficiently different from that of AH-64, that even if the McDonnell-Bell team were selected to enter production, the start costs would be very close. Yes, the small differences in start-up cost have been considered.

QUESTION. General RisCassi, if Apache procurement ends in 1989, when will you fill your attack helicopter requirements with the new Scout Attack version?

ANSWER. We currently plan to begin fielding the LHX Scout Attack version in the 4th Quarter FY95, contingent on approval of the LHX program.

QUESTION. Are you concerned with the ability of the country to mobilize during the period after the Apache line closes and before LHX starts at full rate production?

ANSWER. Yes.

QUESTION. Was this factor considered in the Apache decision?

ANSWER. Yes. Also included in our consideration was the risk in not replacing the current "light fleet", which is over 20 year of age.

QUESTION. General Wagner, according to your testimony the flyaway cost of the Apache is more than $9 million in 1988. This is 7% higher than anticipated last year. Can you explain the specific reasons for the increase? What portion is attributed to the lower production rate and what part to other factors?

ANSWER. The 7% increase resulted from learning curve losses (approximately 2% of the increase), higher direct labor, material and overhead rates and the increased costs associated with absorbing aircraft modifications and improvements (such as flight data recorders, blue/green lighting and wire strike protection system) within existing funding.

BLACKHAWK HELICOPTERS

QUESTION. General Riscassi, your requirement for UH-60 Blackhawk is 1,775, but the Army only plans to procure 1,107. What portion of the reserve component requirement will not be filled?

ANSWER. The UH-60 requirement is 2816 which can reduced to 1775 with the procurement of the V-22. If the Army only buys 1,107 Blackhawks, eighty percent (80 %) of the reserve component will not be filled.

QUESTION. What percent of the active force requirement will not be filled?

ANSWER. If the Army only buys 1,107 of the 1775 Blackhawks, eight percent (8%) of the active component will not be filled.

QUESTION. General Wagner, in Fiscal Year 1988, the Army plans to enter into a new multiyear contract for the Black Hawk. However, you have decreased your total inventory objective by 668 aircraft. What is the impact on your expected total cost of this program?

ANSWER. The Army procurement objective remains 1107. Although 1775 is a valid requirement it has never been approved due to affordability constraints and other funding and operational priorities.

QUESTION. The unit flyaway cost of this program is increasing by more than $1.2 million in Fiscal Year 1988. What portion is due to a change in quantity and what amount to other factors.

ANSWER. The reduction of the UH-60A production rate from 78 in FY 1987 to 61 in FY 1988 will increase the estimated unit flyaway cost by $.3 million. The balance of the increase of $.9 million is attributable to other factors as summarized below:

Inflation		$ .1 million
Procurement of items not procured in FY 1987		.3 million
Hellfire	(.2)	
Fuel cell, reserve hoist adapter and manprint	(.1)	
Aircraft improvements not incoporated in FY 1987		.1 million
Warranty Clause		.2 million
Increased Mission Kits prorated over a lesser quantity of aircraft (i.e., greater than previous ratios)		.2 million
Total FY 1988 Unit Flyaway Cost		$5.7 million

QUESTION. What would be the expected flyaway cost of this program if you maintained a stable production rate under a new multiyear contract?

ANSWER. The estimated unit flyaway cost for an Army UH-60 production rate of 96 per year in FY 1988 is $5.2 million.

QUESTION. What are the expected savings from the next multiyear contract?

ANSWER. Estimated savings for a four-year (FY 1988 - 1991) airframe multiyear contract for the UH-60A Black Hawk is at least $116.4 million and 12% over the single year price.

ARMY HELICOPTER IMPROVEMENT PROGRAM (AHIP)

QUESTION. General Wagner, the Army claims it requires 179 AHIP helicopters to fill the Field Artillery Aerial Observation Mission, but even if the Committee allows 1987 dollars to be spent, only 135 will be purchased prior to Army cancellation. Why hasn't the Army funded the remaining 44 aircraft?

ANSWER . AHIP was terminated for affordability and not mission requirements.

QUESTION. Is AHIP a low priority program?

ANSWER. No. AHIP termination was based on Army affordability issues.

QUESTION. General RisCassi, what would be the planned deployment scheme if a total of only 99 AHIP helicopters were purchased?

ANSWER. The Army has not staffed a fielding plan for 99 AHIP's. We would have to decide wether we field divisional FAAO platoons or Corps FAAO companies as the priority. The big impact will be that Europe will lose either 24 or 30 AHIP's from the program we have designed with the 135 AHIP's. Therefore, our forward deployed FAAO units are only 50% modernized (approximately) if we buy 99 AHIP's versus a 100% modernization in our forward deployed FAAO units if we buy 135 AHIP's.

QUESTION. General RisCassi, can you tell the Committee what your views are on the utility and effectiveness of the AHIP?

ANSWER. The Army needs a scout helicopter for our current battlefield requirements. That is what the AHIP was designed to be--an interim scout helicopter to work with the AH-64 and the artillery. The AHIP is currently participating in the Army Aerial Scout Test to assess its scout performance. The initial reports from Ft. Sill training in the FAAO live-fire missions are superb.

QUESTION. General RisCassi, last year the Committee directed the Army to report on how it would meet its scout helicopter requirements through the 1990's. What is the Army doing to respond to this requirement?

ANSWER. Under Secretary Ambrose sent a letter to Congress in Jan 1987 that laid this out. We are conducting the Army Aerial Scout Test and will provide answers to Congress in late Aug or early Sep 1987.

QUESTION. The Committee questioned the night anti-tank capability of using either an OH-58A or OH-58C scout helicopter teamed with an AH-64. Does the Army agree with the Committee's position? If not, why?

ANSWER. AHIP termination was an affordability decision. Obviously, the Army is accepting a degraded night capability due to AHIP termination. The Army Aerial Scout Test is designed to provide data on this question.

QUESTION. If the Army agrees, what near-term alternative is supported by the Army to address this problem?

ANSWER. I prefer to not guess the outcomes of our testing. The Army will report to Congress in late Aug or early Sep 1987.

SPECIAL OPERATIONS MODIFICATIONS

QUESTION. Last year, the Congress did not fund the initial special operations aircraft modification program request of $3.5 million because of concurrency with development. This year the Army request is $121.8 million. What assurance can you provide that the first year of production requires $121.8 million?

ANSWER. FY 1988 APA funds represent initial procurement of selected equipment for installation in the SOF configured aircraft. These items are developed and available for procurement in FY 1988. Examples are: Aerial Refueling System and Probe, mission computers, terrain following/terrain avoidance (TF/TA) Radar, FLIR, and Aircraft Survivability Equipment (ASE). The basis for the acquisition cost estimate is a detailed cost analysis that uses analogy with the CH-47D, UH-60A and other helicopter programs.

QUESTION. Considering budget constraints, regardless of Congressional pressure, does the Army believe this rapid ramp-up is the most prudent course.

ANSWER. Yes, the 1983 SOF mission area analysis stated a lack of air support for SOF as the number one deficiency. This deficiency has continued although improvements have been made. This program supports the Secretary of Defense decision on April 1, 1986 to transfer the rotary wing long range penetration mission from the USAF to the Army. This will provide to the field, helicopter systems with the capability to meet SOF mission requirements.

QUESTION. What would be the effect of proceeding with a much more modest program?

ANSWER. This would not only delay the established fielding date but more importantly would further delay the much needed rotary wing long range penetration capability to support the Special Forces and Rangers.

GOLDEN KNIGHTS AIRCRAFT

QUESTION. Last year there were no plans reflected in the budget to purchase Golden Knights replacement aircraft. When was this requirement added?

ANSWER. The requirement was added during the FY 88-89 budget development process.

QUESTION. Please provide the cost analysis information which justifies procurement of these aircraft instead of leasing.

ANSWER. The following data was taken from a February 1986 analysis which compared continued leasing or purchase of two F-27 Fokker aircraft in support of the USA Parachute Team (Golden Knights). Although the analysis was centered on the F-27 it also considered other commercial aircraft. It is the Army's intent to compete this procurement. It is anticipated that additional aircraft not mentioned in the following summary would also compete. Although actual execution dates will occur later than indicated in the study, the bottom line remains unchanged - it is cheaper to purchase than to continue leasing to meet this long term requirement.

The U.S. Army Parachute Team (Golden Knights) presently leases two (2) Fokker F-27 as support aircraft to carry out its mission. The present lease agreement including contract options will remain in effect through April 1987. This analysis determines the cost-effectiveness of the acquisition of these assets as opposed to continuing the lease agreement for an extended period of time. These alternatives are in consideration of the Army's objectives to upgrade the aircraft support for the U.S. Army Parachute Team (USAPT). Although, the F-27 does not fully meet the USAPT support aircraft requirements, it represents a substantial improvement over the C7A (CARIBOU) which it replaced. There are several other potential aircraft which may satisfy the USAPT needs. Among these is the CASA (CN-235) which is also considered in the analysis.

The analysis compared the present value of the cumulative Life Cycle Cost (LCC) of the Lease and Buy alternatives and determined the break-even point and the resulting LCC savings. The estimated cost for the acquisition and lease were based on informational quotes obtained from perspective contractors. The base-case alternative considered the acquisition of the F-27s in May 1987 with a twenty (20) year service life thereafter. The acquisition of the F-27 aircraft was determined to be cost effective over continuing the lease. Under the assumptions of the analysis, a breakeven point can be achieved in less than seven (7) years from the date of purchase. Furthermore, a total present value LCC savings (cost-avoidance) of nearly 10 million (FY 1987 dollars) can be expected. The funding requirements for the acquisition of the two (2) F-27 aircraft and support package were determined to be approximately 13 million dollars which will be required in May 1987. The amount was based on the current exchange rate, etc., and is subject to future negotiations at the time of purchase.

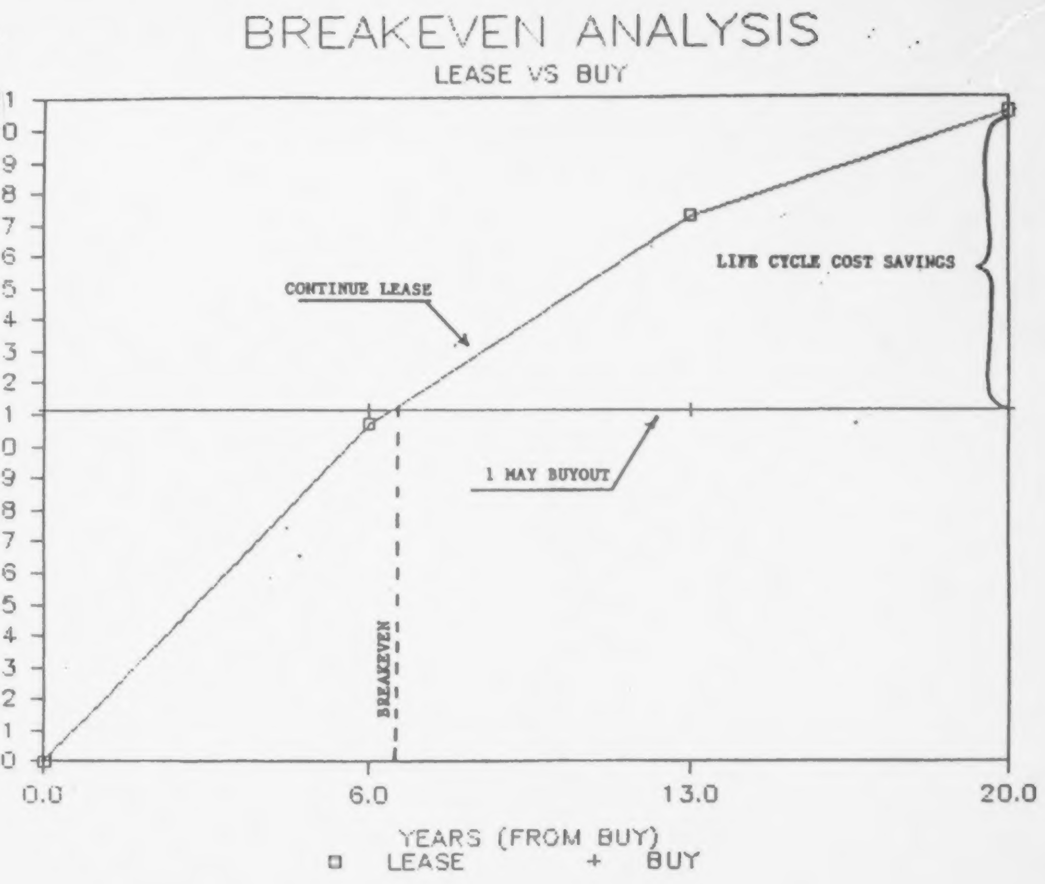
The analysis considered the incremental purchase options of 1 October 1987 and beyond. The results show that the cost-effectiveness of the acquisition alternatives are time-dependent. If the purchase is made later, then the alternative is less cost-effective.

The cost and benefits for the future purchase of alternative aircraft are also being considered. Among these are the CASA (CN-235), the British Aerospace (BAE-748), and the major modification/upgrade to the existing C7A (CARIBOU). Although creditable cost information for these aircraft are still outstanding, tentative information would indicate that the CASA (CN-235) would be only slightly more expensive and would be nearly as cost effective. Additionally, the CN-235 has the added benefit of a rear cargo ramp door which meets current USAPT requirements. For the CN-235, the issue becomes one of certification, desirability, and affordability. The cost effectiveness of modifying/upgrading the C7A to fully meet USAPT requirements would be cost prohibitive and the decision to do so would be questionable due to the increasing age of the aircraft. On the other hand, a minimum modification would be equally undesirable from an effectiveness point of view.

PERFORMANCE AND SPECIFICATIONS
ADDENDUM TO GOLDEN KNIGHTS AIRCRAFT SUPPORT COST ANALYSIS
EXECUTIVE SUMMARY

AIRCRAFT	BASIC EQUIPPED COST	CREW/PAX	MAX T-O WEIGHT, LB.	TAKEOFF DIST, FT. (SL/ISA)	RANGE, NM (NO RESERVE)	NORMAL CRUISE TAS, KTS	SERVICE CEILING, FT.	REMARKS
CASA CN-235	$5.6 mil	3/44	31,746	2600	1940	245	28,500	Cargo ramp, not certified
de Havilland DHC8-100	$6.0 mil	3/40	33,000	3160	2000	265	25,000	Cargo door (left side)
Fokker F27/MK500	$6.5 mil	2/53	45,900	5600	1410	259	25,000	Currently leased
British Aerospace BAe-748-2B	*	3/48	46,500	2700	2000	220	25,000	*
Skytrader ST-1700 Commuter	$2.1 (for 5)	2/24	17,000	450	1100	170	25,000	Est. cert. date (Pt 25) Feb 88. Uncertified version available Aug 87. Pressure vessel available (1000 lbs.)

* Two HS-748-2B aircraft may be acquired for $3.4 mil total.
Cargo door modification estimated $1.25 mil for both aircraft.


BREAKEVEN ANALYSIS
LEASE VS BUY
DISCOUNTED COST (FY87$M)
21
20
19
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17
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14
13
12
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6
5
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3
2
1
0
0.0
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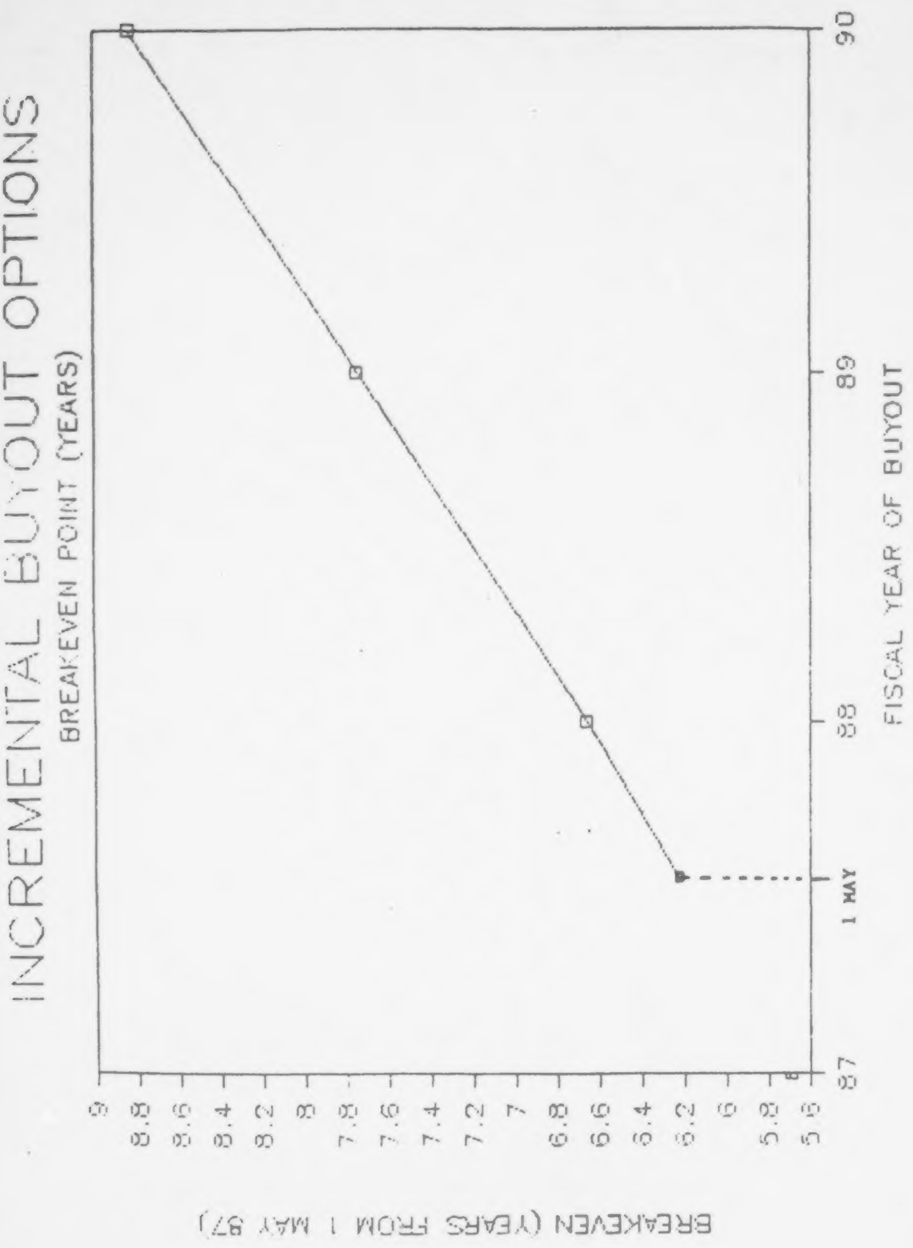
13.0
20.0
YEARS (FROM BUY)
□ LEASE
+ BUY
CONTINUE LEASE
LIFE CYCLE COST SAVINGS
1 MAY BUYOUT
BREAKEVEN


INCREMENTAL BUYOUT OPTIONS
BREAKEVEN POINT (YEARS)
BREAKEVEN (YEARS FROM 1 MAY 87)
9
8.8
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8.4
8.2
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7.6
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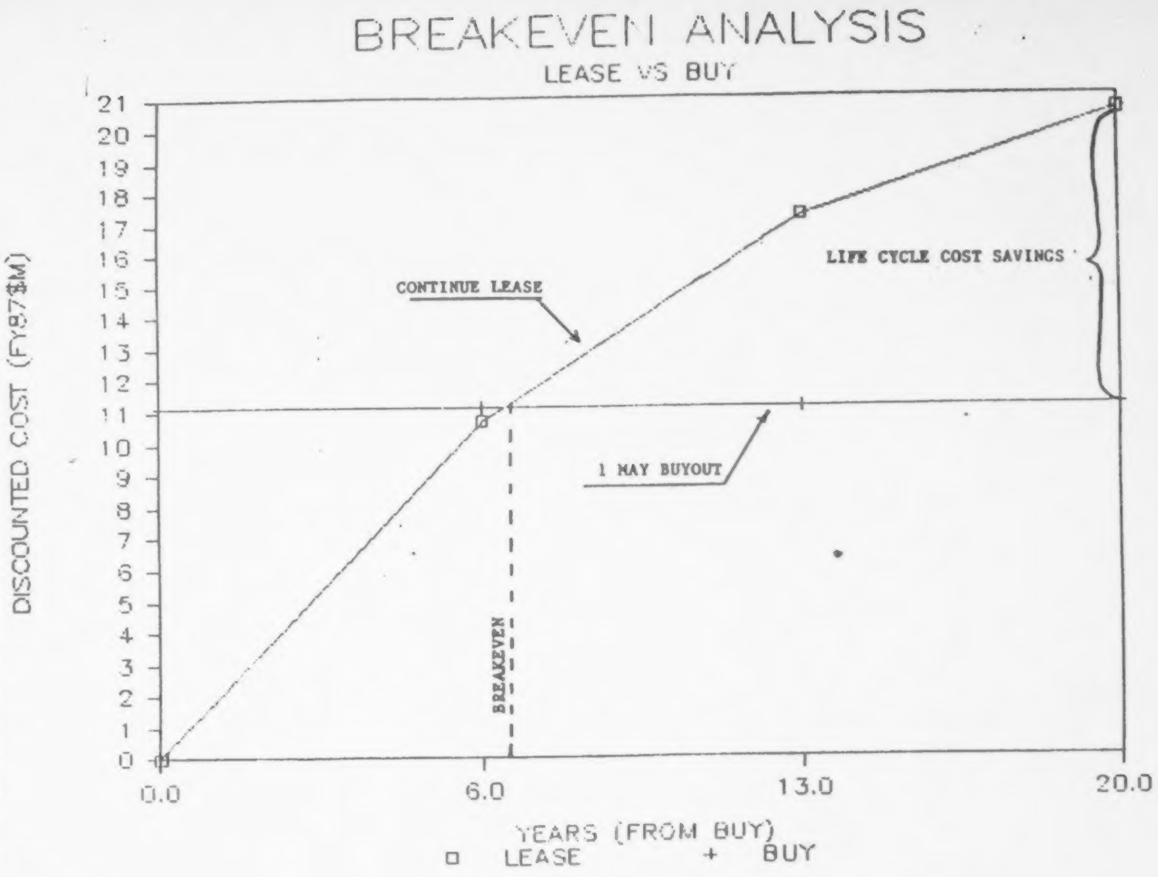
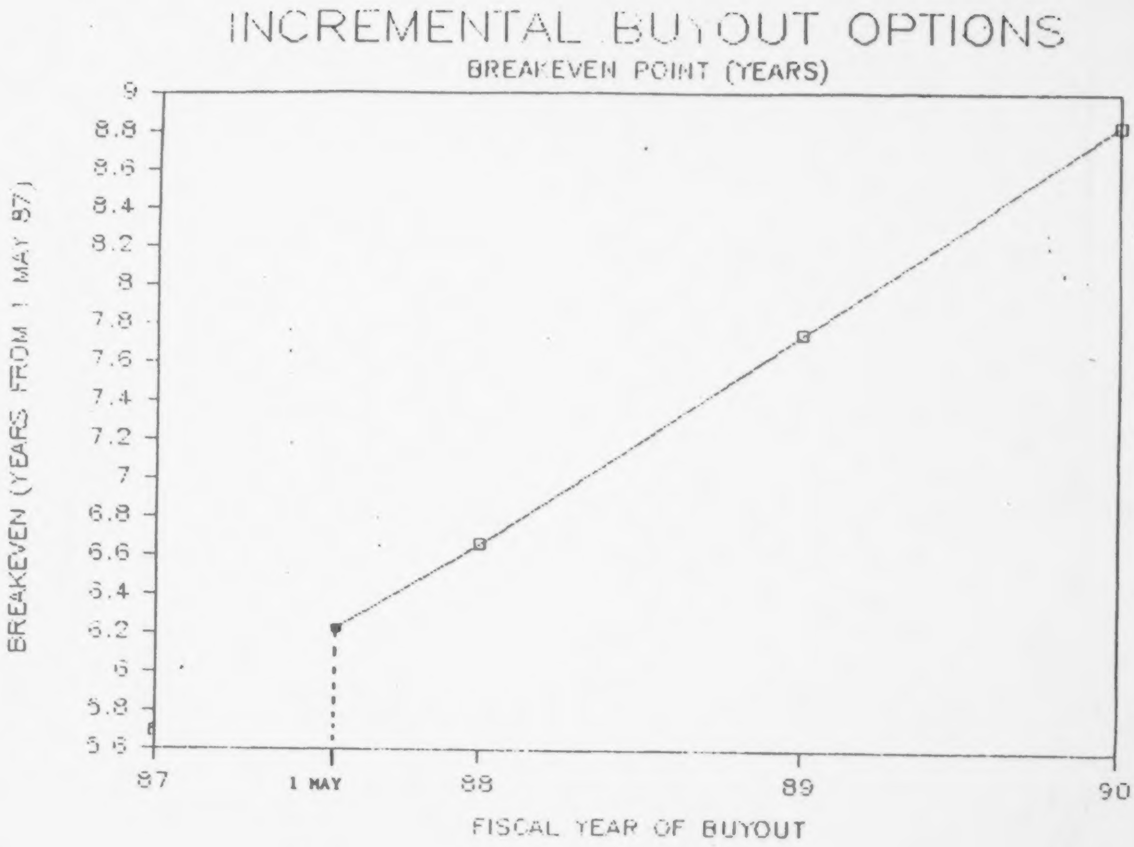
7.2
7
6.8
6.6
6.4
6.2
6
5.8
5.6
87
1 MAY
88
89
90
FISCAL YEAR OF BUYOUT

PERFORMANCE AND SPECIFICATIONS
ADDENDUM TO GOLDEN KNIGHTS AIRCRAFT SUPPORT COST ANALYSIS
EXECUTIVE SUMMARY

AIRCRAFT	BASIC EQUIPPED COST	CREW/PAX	MAX T-O WEIGHT, LB.	TAKEOFF DIST, FT. (SL/ISA)	RANGE, NM (NO RESERVE)	NORMAL CRUISE TAS, KTS	SERVICE CEILING, FT.	REMARKS
CASA CN-235	$5.6 mil	3/44	31,746	2600	1940	245	28,500	Cargo ramp, not certified
de Havilland DHC8-100	$6.0 mil	3/40	33,000	3160	2000	265	25,000	Cargo door (left side)
Fokker F27/MK500	$6.5 mil	2/53	45,900	5600	1410	259	25,000	Currently leased
British Aerospace BAe-748-2B	*	3/48	46,500	2700	2000	220	25,000	*
Skytrader ST-1700 Commuter	$2.1 (for 5)	2/24	17,000	450	1100	170	25,000	Est. cert. date (Pt 25) Feb 88. Uncertified version available Aug 87. Pressure vessel available (1000 lbs.)

* Two HS-748-2B aircraft may be acquired for $3.4 mil total.
Cargo door modification estimated $1.25 mil for both aircraft.


BREAKEVEN ANALYSIS
LEASE VS BUY
DISCOUNTED COST (FY87$M)
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
0.0
6.0
13.0
20.0
YEARS (FROM BUY)
□ LEASE
+ BUY
CONTINUE LEASE
1 MAY BUYOUT
BREAKEVEN
LIFE CYCLE COST SAVINGS


INCREMENTAL BUYOUT OPTIONS
BREAKEVEN POINT (YEARS)
BREAKEVEN (YEARS FROM 1 MAY 87)
9
8.8
8.6
8.4
8.2
8
7.8
7.6
7.4
7.2
7
6.8
6.6
6.4
6.2
6
5.8
5.6
87
1 MAY
88
89
90
FISCAL YEAR OF BUYOUT

GOLDEN KNIGHTS AIRCRAFT

QUESTION. If the lease expires in April 1987, what are the Army's plans and anticipated cost of filling the requirement between April 1987 and the delivery of the new aircraft?

ANSWER. The mission will be accomplished through an on-going lease of two F-27 aircraft and the assigned Army U-21 aircraft which provides the support for these missions within their range of Fort Bragg. The lease of the two F-27 aircraft for 19 months which includes, contractor technical representatives, maintenance reserves, repair parts, and insurance will cost $5.1M.

QUESTION. Why is replacement of Golden Knights aircraft a higher priority than advance procurement for Apache or continued production of AHIP?

ANSWER. The Golden Knights are authorized five 1960 vintage Caribou C-7 aircraft to support the team deployment to performances and competitions, as well as, serve as a platform for jumps. The age, maintainability and reliability of these older C-7 aircraft resulted in an Army initiative to seek immediate suitable replacement while allowing time to develop a long-term acquisition strategy. The option to lease suitable replacement aircraft was selected to provide a near-term solution (as no aircraft was available "off the shelf" to meet the Golden Knights' aircraft requirements) and allow time to seek Congressional approval to acquire permanent replacement aircraft. The priority reflects the desire to replace the older C-7 aircraft and the concern for the safety of the flight crews and team members as these aircraft fly throughout the United States promoting Army exprit de corps, recruiting, and public, as well as, inter-service relations.

LHX ISSUES

QUESTION. General Wagner, when the LHX program was restructured last November, several significant changes occurred in the Army's program goals. LHX cost goals increased by about 17 % for the scout/attack version and 25 % for the utility version; the weight goal increased by 13 %, and the goal for operations and support cost savings decreased by 40-50%.

In addition, just a week ago, a new, independent estimate of LHX R&D costs projected that this component of the entire projected would cost at least 11 % more than the program office estimates.

Doesn't this mean that the LHX will be much more costly to procure and operate than the Army informed the Congress last year during our review of the defense budget request?

What accounts for these increased cost goals, and the difference in the estimates of R&D costs between the independent Army team and the program office?

ANSWER. It means the scout/attack version will cost about 17% more and the utility about 25% more. The Army's independent assessment process is not yet finished. When the differences between the Program Office and the Cost Economic Analysis Center are resolved, the difference will be less than 11% for R&D costs. The Defense Science Board recommended in 1986 that the Army have full competition through development for LHX. That meant two full industry teams for a longer period of time, with commensurate higher costs. This is the principal difference between last years estimate and this year's. Additional increases result from a small acceleration in the development schedule, and a weight increase for the aircraft. The differences within the Army that are now being resolved are mainly in software development and minor airframe cost estimates.

QUESTION. Last year's budget projected that the FY 88 LHX budget would request $194.5 million for airframe R&D. However, that request is for $267.2 million this year -- almost 33 percent real growth. That growth is explained in the budget submission as resulting from "actions to meet an accelerated development schedule for LHX."

Since the Army knew last year that it wanted to begin full scale LHX development in FY 88, why couldn't it project this substantial budget increase at that time, and what unanticipated actions now are required to meet an accelerated development schedule?

General Wagner, last year when you explained why the Army had deferred beginning full scale LHX development until FY 88, you told the Subcommittee:

"Many times on our helicopters in the past we have moved out, have gone into advanced development and full-scale development before we did the proper work in the technology base and up front to make sure we were ready to go."

Why has the Army now decided to accelerate the LHX development schedule, and what specific R&D progress has occurred in the last year which supports a judgement that the program is ready even for full scale development, as well as for acceleration?

How do you reconcile this claim of an accelerated development schedule with the fact that the LHX initial operational capability (IOC) has not been accelerated, and remains in the year 1995?

This will be a very constrained budget year for all parts of the federal government, and programs requesting substantial real growth will be examined particularly closely. For the record, please provide funding profiles and the specific impacts on the LHX program, in terms of cost (constant FY 88 and then year dollars) and IOC, of alternative funding profiles containing real growth of 3%, 10%, 15%, and 20% in FY 88 and FY 89?

ANSWER. The explanation cited is correct, but is only part of the cause. The other major reason is the extension of full competition throughout the development program. There are no other "unanticipated" actions required now. The Army has completed an extensive list of projects in the tech base and ARTI programs that lead to a conclusion that LHX is ready for full scale development. These projects are:

SIMULATION
  ARTI Single Seat Feasibility Demo
  Army Crew Stations R&D Prog
AIRFRAME DEVELOPMENT
  CAP Militarization Tech Prog
  Preliminary Structural Component Test
  Iterative Scale Model Wind Tunnel Tests
  Integrated Technology Rotor Design and Test
  Metal Matrix Transmission Case
  Lubricants Development

Preliminary Flight Control Design
Advanced Digital Optical Control System
ACAP Advanced Tech Landing Gear
Milti-purpose Small Power Unit Demo Prog.
Helicopter Combat Battle Damage Repair Prog.
Crashworthy Fuel Cell Improvements for LHX
Crashworthy Crew Protection for LHX
Lightweight Armor Development
Classified Model Tests

MEP DEVELOPMENT
VHSIC Computer Prelim Design
Software Environment & Detail Design
ADA Tool Development
2nd Gen Detector, Algorithms, and Processor Development
Helicopter Automatic Targeting System Test
EOTAS Prelim Design & Component Dev
Wide Field of View Helmet Mounted Display
Night Pilotage System Prelim Design
ASE Requirements Analysis
Digital Map Data Base Development
ARTI Cockpit Design & Simulation
Int Comm/NAV/Ident Avionics (ICNIA)

T-800 ENGINE FSD (Preceeded by ADTE)
Inlet Particle Separator
Compressor
Combustor
Pwr Turbine Section
Gas Generator Turbine
Engine Controls and Accessories
Development Tests

At the time the FY 87 budget was submitted all LHX planning was based on a First Unit Equipped date of October 1995. Initial Operational Capability (IOC) implies an additional period of time to man, train and evaluate the unit after it is equipped. IOC is now scheduled for November 1995. This is approximately a one year acceleration.

The requested funding streams are below. Since the base year (1987) for this matrix represents a concept evaluation year it is not reasonable to expect that the Army would be able to start a program with that level of funding plus a small real growth. The work statements require greater resources to pursue a reasonable, prudent program.

($ in million)

		FY88		FY89		
Real 1/ Growth	FY87 2/ Request	FY88$	ESC $	FY88$	ESC $	IOC
0%	155.7	160.4	160.4	160.4	165.2	Sep 98
3%		165.0	165.0	169.8	174.9	Mar 98
15%		183.7	183.7	210.5	216.8	Aug 97
20%		191.5	191.5	228.6	235.5	Feb 97

1/ Inflation assumed to be 3% in FY 87 and FY 88.
2/ FY 87 is a concept evaluation year, not an LHX full scale development year.

QUESTION. I understand that the weight of the helicopter may have significant impact on the aircraft's engine performance, agility, and weapons carrying capabilities, thus, on its overall combat capabilities. What accounts for the increase in the LHX's weight goal, and what impact will a heavier LHX have in these areas of combat capability?

ANSWER. The Army has closely monitored the growth in weight of the LHX. At the present design and weight, the aircraft not only meets all agility performances, but also exceeds most minimum requirements as stated in the LHX Required Operational Capability (ROC). The adjustment in LHX's weight goal was as a result of continuing dialog between LHX Program Manager and the two competing airframe teams as they continue to refine the airframe design.

QUESTION. Even if the LHX engine will have the capabilities to carry this additional weight without degredation in the aircraft's overall combat performance, why didn't the Army hold the contractors' feet to the fire to keep the weight within the original goal, and why wasn't the Army better able to estimate the weight of the LHX when it established the original goal?

ANSWER. The Army Leadership has conducted numerous Industry Days with all participating contractors. From these meetings and the contractors response to our Request for Proposal (RFP), this has led the Army to readjust our goals. The Program draws heavily on new technology and in some areas our goals, which were not stated as requirements but as goals, were too agressive.

ONE OR TWO PILOTS IN LHX

QUESTION. A critical unresolved LHX issue is whether the aircraft will carry one or two crewmembers. Industry contends it can build an aircraft enabling one person to fly safely--at low level--while also simultaneously and successfully operating several complicated weapons systems under the stress of enemy fire. I understand the Army agrees that such an aircraft is technically feasible, but that doubt still exist whether even one highly-qualified Army aviator can handle all those complex, dangerous, physical and mental demands under combat conditions. As the LHX program now is structured, the Army does not intend to decide the answer to this question -- and thus whether aircraft will carry one or two crewmembers--until mid-1993, after some early operational tests, and just before production begins. General Wagner, isn't this decision critical to the Army's estimates of LHX's weight and agility, how much it will cost to operate and support, and how much manpower will be required in the Army's already constrained force structure to fight and fly it?

ANSWER. Though a single pilot LHX is technically feasible, the program was designed from the beginning to allow the Army to go with either one or two pilots. The engines have sufficient power margin and the airframe can accommodate either one or two pilots, while still meeting or exceeding all requirements. The current attack battalion with 21 AH-1S and 13 OH-58 aircraft requires 55 pilots. A 25 aircraft LHX attack battalion with much greater effectiveness has a 10% pilot savings with two pilots per aircraft (50 vice 55), plus a 13% savings in maintenance personnel. If demonstrations and simulations prove the one pilot LHX operationally feasible, the additional pilot savings and increased aircraft performance are additional benefits. A premature commitment to a one pilot LHX before it is proven operationally feasible would be unconscionable.

CRITICAL UNRESOLVED ISSUE: LHX PILOTS?

QUESTION. The Army says its basic concept of operations for the LHX requires a helicopter carrying only one crewmember, because it intend to use each LHX about twice as long per operational day as the two-pilot aircraft each replaces and to operate them within basically the same manpower levels as today.

If a two-seat LHX ultimately is selected for production, doesn't this mean that the Army's entire foundation for the program is eliminated, and that the Army either only will be able to fly each LHX half the planned time -- about the same time as today -- or else it will have to provide for twice as many crew members as its plans now contain?

ANSWER. The number of hours flown on an aircraft per day is not just a reflection of having 2 pilots, but a combination of crew work load, cost, technical limit of the aircraft and maintenance man-hours per flight hours. Because of the reduced number of LHX's which replaces the current light fleet aircraft, the force structure (pilots) will not need to be increased even if it's a two seater to gain the efficiencies of the LHX.

LHX ISSUES

QUESTION. It would seem that factors such as amount of daily operational use and the number of crewmembers would have major impacts on the cost and effectiveness of the LHX, yet the Army says its long-awaited Cost and Operational Effectiveness Analysis required by Congress only is based on the single pilot LHX.

Why doesn't basing the LHX cost-effectiveness analysis on the single-pilot variant distort this evaluation, invalidate its utility, and artificially favor the LHX compared to other helicopter alternatives, such as continuing to produce modernized versions of our present helicopters? Why shouldn't Congress require the Army to assess the cost effectiveness of both one-and two-crewmember LHX versions before it approves funds for initiation of full scale development of the aircraft?

General Wagner, earlier this month, the Army's Vice Chief of Staff, General Max Thurman, was quoted as saying that the Cost and Operational Effectiveness Analysis will urge that the LHX program go forward. If an accurate quote, this would seem to indicate that the Army already has prejudged the outcome of a study which is not yet complete and which is supposed to be an objective analysis of helicopter modernization alternatives.

Has the Army "cooked the books" in this cost effectiveness analysis in favor of the LHX, and could you ask General Thurman to provide for the record an explanation of his statement with regard to this concern?

ANSWER. The Army intends to field LHX as a single pilot system and will continue to plan and program for such manning until it has been shown through analysis and testing that single pilot operation is not desirable. Since this is the Army's goal and plan, it does not distort the analysis or invalidate its utility to compare it in this way to systems that must have two pilots, bigger engines, higher gross weights or any other inherent characteristics. In order to answer the one vs. two pilot question the Army will prototype both configurations. This will allow testing as well as analysis. This is the way to get to the answer, not through study of variables that are too difficult to quantify. The Army completed preliminary analysis of the LHX COEA in July 1986 and November 1986. Both efforts showed dramatic increases in effectiveness for both LHX new start programs (helicopter and tilt rotor). Following both of these outcomes, the Army leadership directed further analysis to be sure of the results, and more gaming simulations to accomodate OSD requirements. Although the Vice Chief of Staff had only preliminary results, he was certain of the outcome in gross terms. It is believed the final product will validate his earlier prediction. There was absolutely no effort on the Army's part to run a less then totally objective COEA. The OSD will carefully examine the COEA before they provide a final approval.

ARMY COST EFFECTIVENESS ANALYSIS

QUESTION. General Wagner, isn't the critical decision whether the LHX will carry one or two crewmembers being made too late in this program? If required by Congress, how much earlier could the Army make such a decision?

ANSWER. If required by Congress and supported with sufficient analytical funding and simulation effort up front, the Army could define the one vs two pilot requirement by Critical Design Review (CDR), June 1989. However, in the absence of this detailed analysis effort commitment to a one pilot LHX before it is proven operationally feasible would be unconscionable.

QUESTION: What specific steps will the Army take between now and 1993 to ensure that, if a two crewmember LHX ultimately is chosen then, it will have enough pilots to operate the aircraft in combat and still have enough personnel to meet other Army requirements?

ANSWER Our present force structure will support the two seat requirement. Since LHX replaces the current fleet at less than one for one there would still be a personnel savings with a two pilot LHX. This savings can be used to increase the unit's operational capabilities or applied against other Army shortfalls.

SIGNIFICANT WEIGHT ISSUES

QUESTION. The Army estimates that a second LHX crewman, and all his support equipment will add approximately 800 pounds the helicopter, but that the LHX engine under development will be able to accomodate the additional weight without degredation in helicopter combat performance. On the other hand, the Army acknowledges that the additional weight will impact on the LHX's agility and engine power available for other purposes. Can you reconcile the apparent contradictions in these claims?

ANSWER . Historically, all aircraft have increased in weight impacting on performance. The T 800 engine was intentionally designed to allow the airframe to grow; hence, though there is an impact on agility and engine power the LHX will still meet or exceed the required operational capability.

QUESTION. The Army says that the new weight goal for the LHX of 9,000 pounds, plus or minus 500 pounds, does not include the weight of an additional crewmember and his support equipment. Of what validity is a program goal which does not accurately reflect what ultimately could be the final configuration of the LHX?

ANSWER. Army stated it's Goals as Goals, not requirements. You modify goals as required based upon COEA Results and Program Cost and risk. There is sufficient space, weight, and power margin built into the airfame and engine to accept the additional weight.

TECHNOLOGICAL RISKS

QUESTION. Your statement raises questions about the maturity of the technologies intended to give the LHX its increased combat effectiveness and single-pilot capability. On the one hand, you say contend that LHX technologies are proven; on the other, you list several "principal areas of risk," primarily in the sophisticated equipment required for combat success. What degree of risk would you assign to each of the risk areas you identify in your testimony -- high, medium, or low, and have you identified yet the solutions needed to eliminate these risks? Why can't the Army demonstrate further reductions in the risks in these areas before full scale engineering development is initiated?

(For the record, please identify the specific approaches the Army has identified to further reduce the risks in each of these technology areas, and in any other areas of the LHX program considered of medium or high risk, and please identify the year in which the Army expects each risk area to become low risk.)

ANSWER. All of the risk areas in the LHX program are low to medium risk. The Army could achieve lower risk by keeping the LHX program in concept evaluation longer. This would not be prudent however because there is even greater risk in having the greater majority of our helicopter assets employing Vietnam era capability. We must balance risks and go forward with a prudent program. That is what we have now. A risk matrix is attached. If the military never moved a program into full scale development until every design area was low risk we would never be able to keep up with or get ahead of our potential adversaries. The key is to properly identify the areas of risk and then to take action to lower that risk. We have done that in the LHX program.

RISK AREA	RISK (1988)	APPROACH TO REDUCE RISK	LOW RISK YEAR
o Aided Targeting	Med	Risk Reduction improved algorithm parallel alternate development 1987-1989. Sensor Fusion Test Bed demos 1987-1988.	1991
o Integrated Communication, Navigation, Identification Avionics (ICNIA)	Med	Laboratory Demonstration 1987, brass board flight demonstration 1988. LHX prototype hardware 1990.	1990
o Mission Equipment Package			
- VHSIC Mission Computer	Med	Detail design and breadboard/brassboard demonstrations Aug-Sep 1987. Critical component parallel alternate designs/demos 1987-1988. Prototype Hardware - 1990.	1990
- Night Pilotage System			
o Sensor Forward Looking Infrared (FLIR)	Med	Design and breadboard/brassboard demonstrations Aug-Sep 1987. Contractors pursuing parallel - alternate design demonstrations 1987-1988. Army Tech base Focal Plane Array FLIR demos 1988 and 1989.	1991
o Wide Field of View Helmet Mounted Displays	Med	Design and breadboard/brassboard demonstrations Aug-Sep 1987. Contractors pursuing parallel - alternate design/demos 1987-1988.	1990
- Electro Optical Target Acquisition Designation System (EOTADS)			
o Sensors	Med	Design and breadboard/brassboard demonstrations Aug-Sep 1987. Contractors pursuing parallel - alternate design demonstrations 1987-1988. Army Tech base Focal Plane Array FLIR demos 1988 and 1989.	1991

SUMMARY QUESTION

QUESTION. General Wagner, you contend in your statement that "the Army is ready to begin LHX development. However, there seem to be some very significant, unanswered questions which remain about the program in the areas of continued technological risk, differing cost estimates, changing program cost and weight goals, the critical unresolved issue of one or two LHX crewmembers, and the validity of the required Cost and Operational Effectiveness Analysis. There also are serious concerns about how the Army's current aviation program reduces the nation's defense mobilization industrial base.

General Wagner, considering all these questions, why should the Army rush forward into full scale development of LHX? Shouldn't we slow this program down, permit you to answer some of these concerns, and perhaps use some of this money to continue production of proven Army helicopters for longer into the future than currently planned?

ANSWER. If funds were available the Army would continue to buy the AH-64 and UH-60 helicopters. These helicopters were designed and built to provide an increase in capability against the threat possessed by the Warsaw Pact Nations in the 1980's. The AH-64 provides a credible armor destroying punch for our heavy divisions and corps. The UH-60 provides cargo and personnel movement capability for division and corps forces. The LHX is being designed to replace the AH-1, UH-1 and OH-58 helicopters in the Army's light divisions and corps beginning in 1995. Our objective is to field a helicopter that will have a greater capability than the AH-64 and UH-60. The Cost and Operational Effectiveness Analysis shows that LHX is that helicopter. No one questions the need to replace the AH-1, UH-1, and OH-58 scout helicopters. We have about 7000 of those aircraft. It is essential that we get on with modernizing the aviation fleet and LHX is the way to do it.

Manpower Impact of LHX

QUESTION. What will be the manpower impact if the Army decides to develop a two versus a one man LHX?

ANSWER. The manpower requirements to support a two man LHX are being reviewed. Preliminary findings indicate that no additional manpower will be required.

QUESTION. When will this decision be made?

The LHX acquisition strategy is designed to evaluate government and industry data with the potential for a decision as early as June 1989 during the critical design review, or as late as May 1993 after completion of the LHX Early Unit Test and Experimentation. An early decision is desirable, however, no decision will be made until sufficient data is available due to the long range implications of the single pilot decision.

QUESTION. If a two man version is selected, will the Army seek an increase in Active duty end strength?

ANSWER. The manpower requirements to support the two man LHX are being reviewed. Preliminary findings indicate that no additional manpower will be required. The Army is reviewing the LHX fielding plan to determine if additional manpower will be required during the transition phase of system fielding.

PILOT DEMOGRAPHICS

QUESTION. For fiscal years 1978 through 1987, please provide the following pilot data for both helicopters and fixed wing aircraft:1) number of pilots in the Army 2) average number of pilots on flight duty; 3) pilots by grade; 4) pilot training loads, and 5) pilot retention/ loss rates:

ANSWER. Data is not available to fully differentiate between helicopter and fixed wing statistics. The following reflects aggregate data for helicopters and fixed wing aircraft. Additionally, data is not currently available for FY 1987.

1978 1) Number of pilots - 13,088
2) Average number pilots on flight duty - 8957
3) Pilots by grade: 07 - 5 W4 - 512
06 - 227 W3 - 2378
05 - 1031 W2 - 1481
04 - 2852 W1 - 1027
03 - 3268
02 - 266
01 - 41
4) Pilot training loads - 691
5) Pilot loss rates - 7.4%

1979 1) Number of pilots - 12,421
2) Average number of pilots on flight duty - 8283
3) Pilots by grade: 07 - 4 W4 - 536
06 - 158 W3 - 2428
05 - 792 W2 - 1334
04 - 3132 W1 - 955
03 - 2534
02 - 349
01 - 199
4) Pilot training loads - 777
5) Pilot loss rates 8.7

1980 1) Number of pilots - 11,709
2) Average number of pilots on flight duty - 8094
3) Pilots by grade: 07 - 1 W4 - 511
06 - 155 W3 - 2460
05 - 862 W2 - 1178
04 - 2814 W1 - 813
03 - 2272
02 - 293
01 - 350
4) Pilot training loads - 1084
5) Pilot loss rates - 10.3%

1981 1) Number of pilots - 11,473
2) Average number pilots on flight duty - 8,516
3) Pilots by grade: 07 - 1 W4 - 687
06 - 112 W3 - 2240
05 - 763 W2 - 1187
04 - 2007 W1 - 1249
03 - 2426
02 - 437
01 - 364
4) Pilot training loads - 1417
5) Pilot loss rates - 8.7%

1982 1) Number of pilots - 11,875
2) Average number of pilots on flight duty - 8,593
3) Pilots by grade: 07 - 0
06 - 101
05 - 911
04 - 1986
03 - 2008
02 - 736
01 - 256
W4 - 1170
W3 - 1810
W2 - 1415
W1 - 1482
4) Pilot training loads - 1440
5) Pilot loss rates - 7.2%

1983 1) Number of pilots - 13140
2) Average number of pilots on flight duty - 10225
3) Pilots by grade: 07 - 0
06 - 84
05 - 1066
04 - 1848
03 - 2497
02 - 622
01 - 553
W4 - 1073
W3 - 1941
W2 - 1870
W1 - 1586
4) Pilot training loads - 1519
5) Pilot loss rates - 5.1%

1984 1) Number of pilots - 13646
2) Average number of pilots on flight duty - 10,225
3) Pilots by grade: 07 - 1
06 - 83
05 - 1239
04 - 1689
03 - 2793
02 - 717
01 - 476
W4 - 1330
W3 - 1684
W2 - 2239
W1 - 1395
4) Pilot training loads - 1366
5) Pilot loss rates - 6.4%

1984 1) Number of pilots - 13646
2) Average number pilots on flight duty - 10,658
3) Pilots by grade: 07 - 1
06 - 83
05 - 1239
04 - 1689
03 - 2793
02 - 717
01 - 476
W4 - 1330
W3 - 1684
W2 - 2239
W1 - 1395
4) Pilot training loads - 1,366
5) Pilot loss rates - 6.4%

1985 1) Number of pilots - 13,898
2) Average number of pilots on flight duty - 10,463
3) Pilots by grade: 07 - 2
06 - 70
05 - 1094
04 - 1830
03 - 2984
02 - 658
01 - 577
W4 - 1371
W3 - 1721
W2 - 2261
W1 - 1330
4) Pilot training loads - 1307
5) Pilot loss rates - 7.%

1986 1) Number of pilots - 13,429
2) Average number of pilots on flight duty - 10,491
3) Pilots by grade: 07 - 2 W4 - 1690
06 - 73 W3 - 1268
05 - 1012 W2 - 2504
04 - 1552 W1 - 840
03 - 3005
02 - 692
01 - 791
4) Pilot training loads - 793
5) Pilot loss rates - 8.5%

PILOT AGE AND SERVICE

QUESTION. For this same period, what is the average age and years of service for Army pilots.

ANSWER. Data on average age and years of service for Army pilots for fiscal years 1978 through 1987 is not readily available. The data could be extracted from historical data base archives in 30-60 days.

WARRANT OFFICERS

QUESTION. Why does the Army maintain a Warrant Officer Corps? What percentage of Army Warrant Officers are pilots?

ANSWER. Warrant Officers are technicians provided to to fill positions at the middle management level too specialized in scope to permit effective development and continued utilization of commissioned officers who are developed to function primarily in command, managerial and executive positions involving integration of multiple functions. Warrant Officer skill, when equated to those of civilian industry, place the Warrant Officer between the manual trades and professional occupations. Warrant Officers skills cannot be equated to those of a commissioned officer who is required to remain flexible in assignment and utilization. In command and staff positions, the duties, responsibilities, and qualifications of the commissioned officer are broad, and become more so, as the officer advances in grade/performs in assignments of greater scope and develops as a multifunctional manager. Warrant officers, on the other hand, are qualified in depths. Warrant Officers duties, responsibilities and qualifications are so technical that their assignments and utlization are relatively inflexible and must be repetitive in order to maintain their technical skills at a high level of proficiency.

Forty - three percent (43%) of Army Warrant Officers are pilots

ENLISTED AVIATORS

QUESTION: Please explain the Army's use of enlisted men as pilots.

ANSWER: The Army does not currently use enlisted soldiers as pilots. There is an on-going study to determine the feasibility of using enlisted soldiers as pilots. This initiative is scheduled to be briefed to the Vice Chief of Staff, Army on 7 April 1987 in preparation for a decision brief to the

Chief of Staff, Army in the near future. If adopted, it is envisioned that this program would enable the Army to convert some Warrant Officer spaces to enlisted aviator spaces.

Army Flight Training

QUESTION. General Wagner, for fiscal years 1978 through 1988, please provide the budget (both planned and actual) for Army flight training.

ANSWER. Budget data is provided. ($000)

FY	78	79	80	81	82	83
Request	60,705	79,668	96,644	98,841	137,560	140,270
Actual	48,885	56,437	89,264	102,293	108,172	121,512

FY	84	85	86	87	88
Request	137,937	137,279	129,726	165,901	166,305
Actual	112,692	124,106	138,373		

Flying Hours

QUESTION. General Wagner, for fiscal years 1978 through 1988, please provide the number of flying hours (both planned and actual) for Army helicopters and fixed wing aircraft. Provide a breakout of Army flying hours by function (e.g., MDW, training, etc.). Provide hours per crew per month for each year---including how many total hours and total crews are included in the computation.

ANSWER. Programed and actual hours for Army helicopters and fixed wing aircraft are provided for FY 1978 through FY 1988. Hours are in thousands.

FY		78	79	80	81	82	83
Helicopter	Programed	1272	1289	1329	1361	1368	1461
	Actual	1245	1266	1363	1445	1403	1406
Fixed Wing	Programed	166	162	162	164	160	184
	Actual	168	166	162	167	171	183

FY		84	85	86	87	88
Helicopter	Programed	1450	1602	1707	1589	1659
	Actual	1398	1381	1482		
Fixed Wing	Programed	185	192	204	191	190
	Actual	170	170	187		

Breakout of Army flying hours is provided for active, National Guard and US Army Reserves. Detailed data is not available for FY's 1978 through 1982. Level of detail on number of hours for training etc. is not available. Hours are in thousands.

	78-82	83	84	85	86	87	88
Active	Detail Data Not Available	1222	1193	1162	1266	1331	1395
NGB		293	303	319	330	359	358
USAR		74	72	70	73	90	96

OPTEMPO (Hours per crew per month for combat MACOMS only) was not used prior to 1984. FY's 1984 through 1988 is provided.

FY	84	85	86	87	88
Hours (Annual)	579,000	559,000	630,000	688,000	731,000
OPTEMPO(Monthly)	13.5	13.1	13.8	15.5	15.8
Crews	3574	3565	3802	3715	3855

QUESTION. General Wagner, please provide data for Army flying hours to date in fiscal year 1987. How many hours have been lost to grounding.

ANSWER. Flying hour execution was 100.2% of the 1st Quarter Program. Breakout is provided. Hours are in thousands.

FY 87	1st Qtr	FY 87	1st Qtr
Program	348	Program	43
Helicopter		Fixed Wing	
Actual	348	Actual	44

No hours have been reported lost due to groundings this year.

Attack Helicopters

QUESTION. Fifteen of the twenty-three attack helicopter battalions assigned to corps, division or armored cavalry regiment mission in the Army National Guard are supposed to be equipped with the AH-64 "Apache" attack helicopter. One battalion set of Apaches is scheduled to go to North Carolina this year, one battalion set will go to South Carolina next year, and the battalion set designated for the Army National Guard in the FY 1987 budget will go to Florida in 1989. What steps are being taken to equip the other twelve Army National Guard with Apache helicopters?

ANSWER. Current budget constraints have limited the procurement of AH-64 aircraft to 593. A total of 29 AH-64 APACHE battalions will be fielded. Given the Army's strategy of equipping the "first-to-fight" with our most modern, combat capable equipment, there are no current plans to field any more AH-64 battalions to the ARNG.

QUESTION. Can Army National Guard attack helicopter battalions which are equipped with the UH-1M gun ship instead of AH-64s or AH1Ss deploy and fight in the attack helicopter role?

ANSWER. The UH-1M aircraft is not considered a deployable asset in an attack helicopter role. Fielding of the APACHE aircraft to units currently equipped with AH-1S COBRA, both Regular Army and ARNG, will allow for the displacement of AH-1S aircraft into units equipped with the UH-1M. This displacement/modernization effort will result in the retirement of all UH-1M aircraft.

QUESTION. If the AH64 attack helicopter production line is closed in FY 1988, how many more years will pass before day/night, all weather attack helicopter, i.e., the LHX, will be available to meet the requirements of the twelve high-priority ARNG attack helicopter battalions which are not currently equipped with AH64's?

ANSWER. If LHX continues to receive the Army's highest priorities, fielding of LHX would begin in 1995. The current LHX strategy envisions fielding the light attack and cavalry/reconnaissance requirements (18 battalions in ARNG) during the mid to late 1990's. With these fieldings approximately five battalions of AH-1(C-Nite) Cobra's will be displaced to the reserve components to address a portion of the heavy attack night capability shortfall.

QUESTIONS SUBMITTED BY SENATOR BYRD

LHX COST VALIDATION REPORT

QUESTION. By the mid-1990s, the Army's fleet of 8,000+ light helicopters will have been in service for an average of 30 years. The planned procurement of the AH-64 Apache and UH-60 Blackhawk, and the Army Helicopter Improvement Program (AHIP) upgrading the OH-58 Kiowa will have replaced only a small portion of these.

The LHX program seeks to produce a single aircraft, with scout/attack and utility transport variants, to meet operational requirements into the 21st century. At the same time, the Army is hoping to produce an aircraft that will cost no more than approximately $5 million each and will allow a 40% reduction in operating costs.

The Army cost estimates for the LHX have encountered considerable scepticism in Congress and the Pentagon. The scepticism prompted the Senate Appropriations Committee in 1985 to request the Secretary of Defense to have the DOD Cost Analysis Improvement Group certify the validity of the Army's unit cost and operating cost estimates. This report was to have been submitted August 1986. It was not received, and the conferees on the FY 1987 Resolution for Continuing Appropriations prohibited obligation of FY 1987 funds appropriated for the LHX program ($166 million) until receipt of the Secretary's report. As of March 1, 1987, the report had not been received.

ANSWER. The specific difficulty lies in the fact that the Army changed the schedule and strategy for LHX development at the recommendation of the Defense Science Board and invalidated the work done by the Cost Analysis Improvement Group in July of 1986. New cost data has been presented by the Army, but OSD has chosen to defer cost validation until a formal milestone event in April of this year.

U.S. ARMY AVIATION

QUESTION. One alternative to developing a completely new helicopter is continuing the production of the AH-64 Apache and UH-60 Blackhawk. What are the drawbacks to this option? What improvements over the capabilities of the AH-64's and UH-60's will the LHX offer on the battlefield?

ANSWER. The LHX offers significant improvement over, not only the light fleet but also over the AH64 and UH-60 aircraft. The LHX COEA has been completed. Results show the LHX SCAT is more than twice as effective in the European Close-in Battle as the AH-1/OH58C and approximately 80% more effective than the AH64/OH58C. In the Mid-East Deep Battle the LHX SCAT was approximately 25% more effective than the AH-64. LHX will offer 70% commonality between SCAT and the Assault aircraft, furnish a much higher state of reliability/maintainability, greater speed and an O & S cost reduction.

U. S. ARMY AVIATION

QUESTION. The Defense Intelligence Agency has stated that the Soviets are soon to deploy helicopters capable of air-to-air combat. Critics claimed that the LHX program does not address this new threat. What steps is the Army taking to ensure an adequate air-to-air capability for its tactical helicopters?

ANSWER. The LHX SCAT will be optimized for Air-To-Air Combat, as well as air to ground. We consider Air-To-Air and Air-to-Ground co-equal mission. The COEA addressed the air-to-air capability of the LHX against the threat in detail.

X-WING FOR LHX?

QUESTION. The Defense Advanced Research Projects Agency expects the first flight of the Advanced "X-Wing" helicopter within the next two years. This project represents the leading edge of technology and could offer substantial improvements in helicopter speed and manueverability. Nevertheless, the Army has resisted incorporating this technology in the "LHX" program. What considerations have deemed the "X-Wing" unsuitable for the "LHX"? What application is seen for the "X-Wing", if not "LHX"?

ANSWER. The X-wing is considered high risk in both technology and schedule and would be much more expensive to buy and sustain than either LHX or a tilt rotor variant of LHX. Although speed may be important in itself, analysis has shown that in operations consistent with Army doctrine, there are no great increases in effectiveness with high speeds. And certainly no improvements that would justify the major increases in cost that would accrue with X-Wing technology. The Army does not envision a mission for X-Wing at this time, although, there is no question that this technology will be considered for aircraft in the time frame after the LHX.

AHIP CANCELLATION / ADDITIONAL OH-58D FUNDS

QUESTION. Some critics have claimed that the Army's cancellation of the Army Helicopter Improvement Program (AHIP), upon completion of FY 88, is premature and will leave the Army without an adequate helicopter reconnaissance capability well into the 1990's. What were the considerations that led to the program's cancellation?

ANSWER. The AHIP termination was based on affordability issues.

QUESTION. Was the cause one of operational shortcomings or fiscal pressure?

ANSWER. The AHIP termination was based on affordability.

QUESTION. Is the cancellation a trade-off to fund the "LHX" program?

ANSWER. The cancellation of the AHIP, as well as the reduced buy of Apache and Blackhawks, was the result of a reduction in the Army's program and budget and the necessity to cut back on programs throughout the Army's R&D and procurement accounts. Similar cutbacks were made in our M1 tanks production, M2 fighting vehicles and many other vital Army programs.

QUESTION. Is it not true that you need the additional OH-58D aircraft, which the FY 87 funds would provide?

ANSWER. The hold on the FY 87 AHIP funds is a questionable course of action. The Army desires to purchase the 36 AHIP's for the FAAO mission that the FY 87 budget requests; otherwise, the Army would have requested a FY 87 reprogramming action to apply those funds to other areas. The Army needs the 36 AHIP's that the FY 87 funds purchase.

QUESTION. If the Army truly needs the aircraft which the additional funds would provide, is there any reason to withhold the funds any further?

ANSWER. No. The Under Secretary of the Army laid this out to Congress in a Jan 1987 letter, and the Army will provide Congress a report on the scout helicopter mission in late Aug or early Sep 1987.

QUESTIONS SUBMITTED BY SENATOR DECONCINI

AIRCRAFT REDUCED QUANTITY

QUESTION. The Army aviation budget is, quite frankly, unrealistic from a priority perspective and threatening to an American security perspective. The Army Aircraft Procurement Account shows an average decline of 13 percent per year from FY 1987 through FY 1991. These changes reflect the lower than anticipated Apache funding request, the cancelled plan to increase and extend the buy of the cheaper Black Hawk (UH-60) helicopter beyond 1991.

The Apache was designed to complement and eventually replace the AH-1 Cobra, initially fielded in the mid-1960's. The AHIP is a major modification to the OH-58A, which was fielded about 1970. The Black Hawk is to replace the UH-1 Huey, which has been in the inventory since 1960. These new production units are replacing 20 to 30-year old aircraft.

According to the Army, Soviet helicopters have been increasing in quantity and quality. We are all aware of the Soviet effectiveness and lethality with the HIND as an all-purpose helicopter in Afganistan. It can be used for anti-armor, for air-to-air missions, and for transporting troops. They also have two other helicopters which are in development right now -- the HAVOC and the HOKUM. From my understanding, the HAVOC is the Apache's counterpart and the HOKUM is the LHX's counterpart. The Soviets are quickly moving forward on this air-to-air capability.

Now, if the Black Hawk, Apache, and AHIP production lines are all shut down in the next two to three years, by 1991 we not only have cold production lines but we have almost no ability to improve the aging aircraft in inventory since 1960; to respond to a growing Soviet threat; or to replace a potential loss of new aircraft in a conflict. What effect does the reduced quantity have on our national defense?

ANSWER. It is an affordability issue. Given an ideal program we would like a service life extension program (SLEP) for the aging fleet, a warm production base that buys additional AH-64, UH-60 and AHIP aircraft and brings LHX on as programmed. There simply is not enough money to do all of these, therefore, a balanced program across the various mission areas was developed giving full consideration to the risks associated with some very difficult decisions. The result was the President's Budget which provides the maximum capability with the least risk for the dollars available to the Army.

AIRCRAFT 5-YEAR PROCUREMENT PLAN

QUESTION. General RisCassi, what is the Army going to do about the 5-year plan that takes procurement down to near nothing in 1991? And, doesn't this dangerously compromise preparedness and training to allow Apache, Black Hawk, and AHIP lines to go cold five years before LHX production even begins?

ANSWER. We are concerned and we have looked at the deficiencies in the Army for the close, deep and rear operations and have applied the limited dollars available to those programs which provide for a balanced budget. The budget before you and the Army's 5-year procurement plan maintains this balance within the restrained resources available. As the new helicopter comes on in 1995 we will step up procurement. It is a calculated risk that we had to take when we had the significant reductions.

FAAO REQUIREMENT

QUESTION. Given that there is concern internally in the Army for this helicopter modernization program, I would like to ask a few specific questions relating to numbers. I understand that the Army has completed AHIP operational testing. According to reports, the aircraft performed quite well in the Field Artillery Aerial Observation (FAAO) role. The Army has indicated that the FAAO requirement is 179 aircraft. If plans proceed to terminate the aircraft at 135, do you still support the requirement for 135 aircraft?

ANSWER. Yes. The Army desires to purchase the 36 AHIP's for the FAAO mission that the FY 87 budget requests; otherwise, the Army would have requested a FY 87 budget reprogramming action to apply those funds to other areas. The Army needs the 36 AHIP's that the FY 87 budget requests.

QUESTION. Will this be used in the FAAO role?

ANSWER. Yes.

ARMY ACQUISITION PROGRAM

QUESTION. If we buy only 593 Apaches as proposed in the FY 1988-1989 budget, you will end up with 539 in the active force and only 54 in the Guard, which is 20% of your requirement for the Guard and it appears, none for the reserve. This is barely 55% of your requirement. Though I relize that 1206 is an Army Acquisition Objective, those not receiving the Apache will keep the Cobra. Although the Cobras have undergone many improvements in past years, units that keep the Cobra will lose the night, adverse weather, hot climate, and other advantages of the Apache. What effect does this have on where Apaches will be stationed in the U.S. ? How about with battalions in central Europe? Will they be outfitted with Apache as originally planned.

ANSWER. The Army's requirement for Apache is for 1031 aircraft. The Guard's requirement is 12 battalions or 216 aircraft. Based on a 593 Apache buy, 25% of the Guard requirement will be met. The cornerstone of the strategy for distribution of new equipment is to enhance combat capability for worldwide employment. Apache distribution supports this premise. A number of battalions are assigned against Rapid Deployment Force missions to meet the Army's requirements worldwide. Our greatest percentage of Apache units are assigned against NATO missions in central Europe.

APACHE ATTACK HELICOPTERS (AH-64)

QUESTION. In discussing central Europe, we all know about the current negotiations taking place between the United States and the Soviets with respect to the Zero-Zero option. Some European allies may be recalling Oscar Wilde's statement: "When the gods wish to punish us, they answer our prayers". Critics feel that removing these strategic forces leaves the Soviets with a considerable advantage in conventional forces in Europe. Looking at NATO and Warsaw Pact numbers is worrisome. The Warsaw Pact has 46,610 tanks to NATO's 20,314. They have 2,035 armed helicopters to NATO's 714. Added to this, the Germans and the French cannot seem to agree on plans for a new attack helicopter. What is your assessment of this? Are we looking at FMS sales to allies for the Apache? Have we seriously looked at sales to Israel or South Korea?

ANSWER. The Army would welcome the opportunity to provide the Apache to our allies through FMS sales. Germany has expressed an interest in the AH-64 as a "gap filler" for the PAH-2 between now and 1995. The Program Manager visited Israel in 1985 to discuss AH-64 capabilities/operations and although Israel has expressed an interest, funding constraints have negated a committment. South Korea has not expressed an interest in the near-term procurement of APACHE.

GUARD UNITS

QUESTION. Earlier this year in testimony before this committee, we heard about the importance of Guard round-out units. These are aviation units that are mobilized and go to war with active duty Army Divisions and Corps when fighting breaks out. Congress has added Apaches for three of these units in the last three years. What is the shortfall of round-out units in the Guard if no more are procured, as proposed in the FY 1988-89 budget?

ANSWER. There are 15 ARNG attack helicopter battalions that require AH-64's. 10 are considered round-out units. Three of these ten are to receive AH-64's. That leaves a shortfall of 7 ARNG attack battalions requiring AH-64's. However, these 7 units will be resourced with AH-1's and are therefore not a combat unit shortfall.

LHX PRODUCTION

QUESTION. The Army's LHX scout-attack helicopter production is not expected before 1996, or some estimate 1997. (a) Do you feel comfortable with stopping production of what is the world's best attack helicopter and being unable to even replace peacetime losses? (b) Wouldn't it make more sense to keep Apache production at some reduced but economical level, say six or seven a month, until the LHX is ready? (c) Wouldn't this be more cost-effective as well as investing in our national defense?

ANSWER. a. No

b. Only if funds are available to sustain that production, and within the Army's established priorities, those funds are not available.

c. No

APACHE PRODUCTION

QUESTION. How much will it cost the Army to start up Apache production again after the line goes cold? In the Armed Services Committee Hearing last week, General Thurman said, marginal at best. Could you be more specific with numbers, please?

ANSWER. A production restart would cost approximately $800 million to $1 billion in the first year. This includes the cost of reopening the plant, removing equipment from layaway, refurbishing and recalibrating the equipment, hiring a new work force and producing 26 aircraft to achieve a production rate of 4 per month.

APACHE

QUESTION. General John A. Wickham, Chief of Staff of the Army, mentioned the possible extension of the Apache program while testifying a few weeks ago. He has been quoted as saying: "The very next marginal dollar we get from Congress, I would think we would want to put it in the Apache". Last week, General Thurman stated that Apache was the first priority to the Army's buy-back list. What I do not understand, and don't get me wrong because I am a big supporter of the Army's programs, is how we get caught in this position of Apache lines going down five years before the LHX comes on. Its seems that the Air Force and Navy continue their lines until the fighters come on. What is the Army saying inside the walls of the Pentagon and how adamantly are you pushing for the continued aviation funding, apart from add-ons or the next marginal dollar from Congress?

ANSWER. There simply is not enough money to continue all programs in the Department of Defense. The Secretary of the Army and the Army Chief of Staff laid out clearly the requirements of the Army to OSD. After a full hearing the OSD then allocated available funds to each Service. With the available funds a balanced program across the various mission areas was developed giving full consideration to the risks associated with some very difficult decisions. The result was the President's Budget which provides the maximum capability with the least risk for the dollars available to the Army.

ARMY'S WEAPONS BUILDUP

QUESTION. A Defense News article dated January 19, 1987, says that the Army is the loser in the Pentagon's proposed 1988 and 1989 budgets. According to the Center on Budget and Policy Priorities, the Army's weapons buildup will lag behind those of the Air Force and Navy in the next two years. Air Force R&D will rise by $3.56 billion in 1988. Air Force and Navy procurement budgets rise by $4 billion each over the next two years, while Army procurement funds remain essentially flat, growing by $620 million. Does this concern you?

ANSWER. Yes. The concern is not necessarily that the Air Force and Navy are getting more money, but rather the decline in the total budget figure for the Department of Defense.

QUESTION. How does it alter the 5-year Army Plan?

ANSWER. One could see programs stretchout one to four more years to acquire a fixed number of systems or new capability. Certain production lines may close earlier and other lines open later. Reductions in quantities to be purchased, in facilities to be built or in services to be rendered may occur.

APACHE'S AIR-TO-AIR CAPABILITY

QUESTION. When will the Apache have the Stinger air-to-air missile thereby providing air-to-air capability? Will it be retrofit to all Apaches?

ANSWER. Air-to-Air Stinger (ATAS) will be applied as a modification to all 593 Apaches beginning in January 1990 and completing in 1994.

OPERATIONAL SQUADRONS MISSIONS

QUESTION. General, I have been hearing about the operational squadrons that are flying the Apache at Fort Hood, Texas. So far two 18-plane squadrons have fully completed their training and are combat-ready and a third squadron is over half-way trained up, as I understand it. Reportedly they fly about 40% of their flights at night, and they have an excellent availability rate. Is this information I have been getting on target, and what kind of reports have you been hearing from Fort Hood? What kind of availability rates are they getting--is it over 85%?

ANSWER. Your reports are exactly on target. All aspects of fielding are exceeding our expectations at this early point in fielding. Availability rates in the early fielding of new weapons systems are often initially low as we go through a growth/learning curve. The Apache has been unique. Higher-than-anticipated operational ready rates have been attained nearly every reporting period. Availability rates are currently in the mid-seventies.

QUESTION. Gereral, I understand that these Apache squadrons have evolved deep-strike-at-night mission that they fly as part of their training, where they penetrate way beyond enemy lines--and I suppose that maybe I shouldn't say how far in an open hearing--where they fly through enemy defenses and navigate precisely to a known target for simulated attack with Helfire missiles. Can you tell us about those missions and can your existing Cobras do that mission?

ANSWER. The deep strike missions are key to the execution of AirLand Battle doctrine. The Apache is exceeding our expection of its capabilities to perform this mission. The navigation system, target acquisition system, the overall night capability, and increased survivability allows the Apache to strike targets in excess of 100 kilometers beyond the front line of our own troops. The mission could be performed by the AH-1S Cobra, however, its effectiveness and survivability is significantly less.

APACHE OVERALL CAPABILITY

QUESTION. In your judgement, what does this overall capability in the Apache add to the Army's warfighting capabilities?

ANSWER. The Apache affords the field Commander a significant increase in his capability to execute Airland battle doctrine. Significant improvements of the APACHE's combat capabilities are: increased range, improved survivability, significantly increased lethality and range of munitions, and the ability to locate and engage targets during periods of adverse weather and at night.

APACHE COMPARISON

QUESTION. How does the APACHE compare to the Soviet attack helicopters, the HIND, the HAVOC, and the HOKUM?

ANSWER. Considering armaments and target acquisition

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LHX COEA

QUESTION. The Army has issued a study entitled the Cost and Operational Effectiveness Analysis, which I understand is in a rough draft. This report entails a analysis on the LHX program, which will not be completed until the end of this month or next month. As you know, many of the markups in Committees will be taking place as decisions for all these programs have to be made. Given that the LHX is still on paper and the Army has not issued the Cost and Operational Effectiveness Analysis study yet, does it not make sense to proceed with the Apache in order to make sure we have the required weapons, technology base, and labor skill to meet the eventual challenges of an LHX program, whatever form or prototype it eventually assumes?

ANSWER. First of all the Apache and the LHX should not compete for the same money. The LHX is an R & D funding requirememt and the APACHE requires procurement money. They were never designed to go head-to-head for Congressional resources. The LHX COEA is complete, awaiting OSD review and will be provided to the Congress as soon as possible . The emerging results show significant improvement of LHX over the Light Fleet AH-1/OH-58A-C/UH-1's but also a substantial improvement in effectiveness over Heavy Fleet AH-64/ UH-60, with a large O & S cost saving.

QUESTIONS SUBMITTED BY SENATOR GARN

ARMY'S PROCUREMENT CANCELLATION

QUESTION. The Army is canceling the procurement of the AHIP and the Apache. In light of this change, does it make sense to procure more Copperhead and Hellfire missiles in greater quantities than the number of platforms to shoot them from?

ANSWER. Battlefield designators available to support Hellfire and Copperhead are: Apache, AHIP, Aquila, and the ground/vehicle locater laser designator. The programed procurement quantities of these designators supports the programed buy of both Hellfire and Copperhead.

APACHE PROCUREMENT CANCELLATION

QUESTION. What impact will the cancellation of Apache procurement have on the guard fielding new attack helicopter units with the essential wartime required equipment?

ANSWER. The procurement of 593 AH-64's will include resourcing for 3 of 15 ARNG AH-64 attack helicopter battalions. That leaves 12 ARNG units that will not receive AH-64's. These 12 units will be resourced with AH-1 Cobras. The AH-1 is a lower technology attack helicopter and is currently the backbone of our aerial manuever units. The AH-1 is required in all light fleet battalions. These are the attack battalions of infantry divisions (light) and all air cavalry/ reconnaissance units. Retention of the AH-1 in the 12 ARNG (plus the 2 active and 4 USAR battalions that require AH-64's will result in a reduced anti-armor capability. However, the AH-1 is equipped with the TOW missile and 20mm cannon and is a capable antiarmor platform. AH-1 units will provide tactical commanders an aerial combat manuever capability to influence the battle.

GUARD EQUIPMENT

QUESTION. When will the Army equip the next set of AH-64's in the guard? In which guard units does the Army plan to deploy the next set of AH-64's? What is the basis for this deployment decision?

ANSWER. Based on the 593 AH-64 procurement, the Army has no plans to resource ARNG AH-64 units beyond the 3 currently projected.

SUBCOMMITTEE RECESS

Chairman STENNIS. We will recess for now. We have enough other things here this afternoon. We are just going to jump right into the middle of things that are going on down there in Central America. There is open debate on it. You might come if you want to. I invite you anyway.

Any other matter to come before the committee?

I thank all the members, too. We will take a recess, subject to the call of the Chair.

[Whereupon, at 11:53 a.m., Tuesday, March 17, the subcommittee was recessed, to reconvene at the call of the Chair.]

DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 1988

THURSDAY, MARCH 19, 1987

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 9:30 a.m., in room SD–192, Dirksen Senate Office Building, Hon. John C. Stennis (chairman) presiding.

Present: Senators Stennis, Proxmire, Hollings, Johnston, Leahy, Sasser, Stevens, McClure, Garn, Cochran, Kasten, D'Amato, and Rudman.

DEPARTMENT OF DEFENSE

STRATEGIC DEFENSE INITIATIVE ORGANIZATION

STATEMENT OF LT. GEN. JAMES ABRAHAMSON, DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

ACCOMPANIED BY:
- DR. GORDON SMITH, DEPUTY DIRECTOR, SDI ORGANIZATION
- DR. LOU MARQUET, DEPUTY DIRECTOR FOR TECHNOLOGY, SDI ORGANIZATION
- BRIG. GEN. MALCOLM O'NEILL, DEPUTY DIRECTOR FOR PROGRAMS AND SYSTEMS, SDI ORGANIZATION

STRATEGIC DEFENSE INITIATIVE

OPENING STATEMENT OF SENATOR STENNIS

Chairman STENNIS. The subcommittee will please come to order. For the benefit of all, please, let us have quiet so we can proceed right along and hear the witnesses.

Today the Defense Subcommitee begins what will be a series of three hearings into perhaps one of the most ambitious and expensive military research programs ever undertaken by the Department of Defense, the Strategic Defense Initiative or SDI.

With us today as the principal witness is the SDI Program Director, Air Force Lt. Gen. James A. Abrahamson, who has directed this complex and controversial program from the very inception almost 4 years ago.

INTRODUCTION OF WITNESSES

Accompanying him are Dr. Gordon Smith, Deputy Director of SDI, and the two top assistants responsible for all of the major programs in SDI, Dr. Lou Marquet, the Deputy Director for Technology, and Brig. Gen. Malcolm O'Neill, Deputy Director for Programs and Systems.

Welcome to the subcommittee meeting, General. We look forward to your testimony and to asking questions of you and, if necessary, your principal deputies and the top program managers who are sitting behind you.

Next week on Tuesday, March 24 at 9:30 a.m., Ambassador Max M. Kampelman, the chief American negotiator for the Geneva arms talks, will testify about SDI and related administration arms control perspectives.

On Thursday, March 26, at 10 a.m., we will hold our third SDI hearing with former Defense Secretary Harold Brown as our chief witness.

Ambassador Kampelman and Secretary Brown have unique expertise in these issues, as do you, General Abrahamson, and you are all highly respected by Congress. These three hearings should provide our subcommittee with valuable insights to inform our decisions this year on the size, composition, and direction of the President's SDI budget request for fiscal year 1988 and fiscal year 1989.

COMPLEXITY OF SDI PROGRAM

It is no understatement that the SDI program carries with it enormous implications for our military security, the size and composition of future defense budgets, prospects for reasonable arms control agreements with the Soviets and relations with our allies, especially in NATO. These are highly complex matters from both policy and budget perspectives, and, while this subcommittee concerns itself primarily with budget issues, it is difficult to avoid discussing both perspectives since they are virtually inseparable in the case of the SDI.

BUDGET REQUEST FOR SDI

From the budget and program perspective, the administration is seeking $5.2 billion for the Defense Department's share of SDI in fiscal year 1988, by its own calculation an amount which represents growth after inflation of 55.5 percent. The fiscal year 1989 request is for another $6.3 billion, which embodies another 16.4 percent real growth according to the Pentagon.

In addition, the SDI program is requesting a fiscal year 1987 supplemental of $0.5 billion. Now I do not think any of these items have been passed on preliminarily. We have made no conclusions. We have made no decisions and will not until we get these facts and a chance to absorb them.

I will do everything I can to give everyone who has come to these hearings a chance to ask questions in which they are interested and to make the time count.

Are there any brief remarks that any member of the committee wants to make before we start?

Senator PROXMIRE. Mr. Chairman, of course, I would yield to the ranking member if he has remarks to make first, but I would like to follow him.

OPENING REMARKS OF SENATOR STEVENS

Senator STEVENS. Mr. Chairman, I would like to make some comments about this if I may.

I do believe that the hearing is very timely, and these three hearings are going to be the most important this subcommittee will have this year. I believe that the issue of SDI has now become clouded by a debate over interpretation of a treaty. That really has nothing to do with what we are talking about now, and that is the research money to continue the research phase of SDI. I intend to speak later about this on the floor of the Senate. This is not the time for that. I will keep my remarks brief, as you have indicated.

SUPPLEMENTAL REQUEST

I do think it is highly important that we address first the supplemental request and what it means, not only to your program, General Abrahamson, but also what it means to Ambassador Kampelman when he comes next week.

From my point of view, if this President cannot make the decision to deploy SDI, it will fall to the next President to make that decision. We will not be doing our job if we put the next President in a position where he cannot make that decision in the best interest of the country, in my opinion.

I hope that we can find some way to separate out this debate over the interpretation of the ABM from the reality of the research program that General Abrahamson and his colleagues have underway. It is absolutely essential from my point of view that this SDI research program proceed at the fastest pace we can afford.

When I was chairman, Mr. Chairman, I tried to do that. I tried to urge my colleagues to do that, and with your help we were successful. It is my hope that we will have the support we need now, and we can only get that, General Abrahamson, if you and your colleagues and Ambassador Kampelman and others such as former Secretary Brown give us the details that we need to respond to questions and to doubts that are being expressed about the program.

I think it is highly important that we try to concentrate on what is before us, and that is primarily the supplemental request for research and the request for 1988 for research. If we get beyond that, then I think we will not be doing our job, in my opinion.

Senator PROXMIRE. Mr. Chairman.

Chairman STENNIS. Yes, Senator Proxmire.

OPENING REMARKS OF SENATOR PROXMIRE

STAFF REPORT ON SDI

Senator PROXMIRE. Mr. Chairman and General Abrahamson, Senator Johnston and I are giving you a copy today of our 1987 staff report on SDI which contains what we feel are devastating revelations about the Strategic Defense Initiative's efforts to reorient its program toward a near-term deployment.

The 98-page report is based on interviews our staff conducted in the past 2 months with more than 60 SDI scientists, engineers, and ballistic missile defense experts. Our staff visited the Los Alamos National Weapons Lab, the Sandia National Weapons Lab, the Lawrence Livermore National Weapons Lab, the Air Force Base Division, and several SDI contractors. They also received briefing from your top program managers.

A good bit of this report was compiled from classified briefings, and for that reason we are asking you to begin an immediate classification review to tell us by March 30 what parts of this study can be made public.

I might add that last year when we gave you our report for classification review, you provided us with a quick turnaround on it, and we were very grateful for that and very proud of that report. We think you did a fine job of declassifying the parts that could be revealed. So we would like to get the review for this year's report completed just as quickly.

I would also like to say that Senator Johnston will be here shortly, and he and I are today sending copies of the classified report to Chairman Stennis and Chairman Nunn of the Senate Armed Services Committee and Chairman Aspin of the House Armed Services Committee and to Chairman Chappell of the House Defense Appropriations Subcommittee.

Senator STEVENS. Are those going to be furnished to the minority?

Senator PROXMIRE. Oh, yes, by all means, to the ranking members of both sides.

Chairman STENNIS. Senator Hollings.

OPENING REMARKS OF SENATOR HOLLINGS

Senator HOLLINGS. Very briefly, I might just make a comment. Senator Stevens, we cannot unscramble an egg. It raises the point of the narrow interpretation and the calculated and very clever opposition to SDI, and it is not a constitutional crisis they have in mind. What they are trying to do is stop SDI. They are trying to stop it right at this supplemental hearing.

What you must do is look at that treaty to find ongoing—I agree with you on the deployment, Mr. Chairman, on the research that will guide the future, development that will guide the deployment. We will all probably be gone by then maybe. We are trying to decide right here and now what we can do under that treaty and what contracts can be let, and that is what the supplemental is about.

The contracts were let yesterday. I want to know from the General how he gets back this contract in order to conform, let us say, to our narrow view which in turn will put the following on the administration in a box whereby it will be too expensive or unrealistic to proceed.

Now, they know that, and we know that, and I think we ought to face that problem right here at this hearing on supplemental. It is not just a little supplemental amount of money. I wish it were, but the fat is in the fire, and I think we ought to be realistic.

You have been very forthcoming, General, I know, and it has been used against you, to tell you the truth.

Chairman STENNIS. All right, thank you very much, gentlemen. I think we will proceed now, and this will give everybody a chance to have a reasonable amount of time to make examination as they see fit. We appreciate you being here.

Now, the photographers that are here are entitled to be here, but I hope they do not wear out their welcome by walking around cutting off the witnesses' view from those who are testifying.

I have no leanings on this matter. I have promised nothing to anyone on SDI, but, with me, a billion dollars is a lot of money any way you look at it, and this involves several billion. I think we have a terrific responsibility, those who happen to be on this committee. I think you men carry the capabilities of making a judgment, but we certainly are also called on to do our best.

INTRODUCTION OF GENERAL ABRAHAMSON

So we will proceed. I have already welcomed you gentlemen here, and we express appreciation for your being here and your dedication to your work.

Now, we wanted the hearing as a whole today to give every member here a chance to ask questions, but primarily we are here to hear you witnesses give testimony. So, General Abrahamson I will call on you first. We will work out the time schedule that will reach everyone, but we are not going to put any limitation on your time now.

You may proceed, General.

VARIOUS PROJECTS IN SDI PROGRAM

General ABRAHAMSON. Mr. Chairman and members of the committee, it is a pleasure to be back, and I am looking forward, of course, to answering your questions. We did receive guidance from your staff about some of the major issues that you felt we should address. We have tried to include that in an opening statement.

As everybody has commented on, this is a very expensive program and, as such, there are many, many projects. In fact, there are well over 2,000 different individual projects in the program. In the past it has been very difficult to try to explain the scope, the direction and the implications of each of those projects, and so I thought that the best way I could respond both to some of the areas of concern and some of the controversy that has appeared in the press on some of the technical programs was to take a slice of the program and to try to show, in depth, some of the thinking and planning.

The intent, of course, was so that you could get a feel and recognize that there are many further dimensions in many of the projects. By my concentrating on a slice of the program that deals with some of the more mature technologies please do not assume that that means that there is not equal and very careful attention being given to the advanced technologies as well.

PREPARED STATEMENT

If I could start, I would like to use a few slides. I do have an unclassified statement for the record. I will not read from that. It is available to the committee, and we hope that it will be useful to the committee.

Chairman STENNIS. That is your statement there you have in your hand?

General ABRAHAMSON. Yes, sir.

Chairman STENNIS. Well, without objection this statement will be considered given testimony and placed in the record.

[The prepared statement of General Abrahamson follows:]

STATEMENT ON

THE STRATEGIC DEFENSE INITIATIVE

BY

LIEUTENANT GENERAL JAMES A. ABRAHAMSON
DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

Thank you Mr. Chairman for the opportunity to appear before the Defense Subcommittee today. As the Administration requests funding for the fourth and fifth years of the Strategic Defense Initiative (SDI), it is useful to look ahead at the challenges that remain for this very important Initiative. This March marks the fourth anniversary of President Reagan's decision to establish the Strategic Defense Initiative. I am pleased to report that in research and technology development, many exciting developments have taken place over these four years. As a result of their active interest and participation in the SDI Program, our nation's scientific, industrial, and academic communities have fostered some of the finest, most sohisticated technological advances of this decade.

However, while technological advances have filled us with the hope and spirit of what our research might produce, we cannot ignore the fact that some aspects of this world have not changed. As was the case four years ago, and is even more apparent today, the Soviet Union is engaging in a determined, steady buildup of strategic nuclear weaponry improving their capabilities across a wide spectrum of strategic warfare. Moreover, Soviet strategic defenses are extensive and growing. The Soviet Union has the only established anti-ballistic missile system, the only anti-satellite system, the most comprehensive air defense system and the most intensive research and development effort in the application of new technologies to ballistic missile defense in the world today -- ground- and space-based lasers, particle beams and microwave weapons, interceptors, heavy lift space transportation vehicles, and tracking and surveillance systems. The President has charged the Department of Defense with defining real options for using defense to counter the Soviet progress in improving strategic offensive and defensive forces. SDI could provide a hedge against the real potential for Soviet efforts to exploit emerging ballistic missile defense technologies and possible breakout from the ABM Treaty.

The essence of the SDI Program, as directed by the President is to provide effective defense options for a future decision to develop and deploy ballistic missile defenses. Since the ballistic missile threat is the most capable of accomplishing a disarming first strike, we are conducting research to find ways to defend against this threat, thereby providing a better basis for deterring aggression, strengthening strategic stability, and increasing the security of the United States and our allies. Neither the Secretary of Defense nor the President have ever accepted the notion of a defense that would protect only our national command authority or retaliatory forces, and President's consideration of phased or incremental deployment does not imply this policy has changed.

Despite substantial budget reductions by the Congress, we must continue to strive for a balanced program. We must provide the technologies that yield the defense capabilities needed. This requires that we pursue sensor/interceptor concepts for each phase of the ballistic missile flight, and the battle management and command, control and communications (BM/C3) capabilities to guide and manage the overall system. Balance also requires that we not only validate technology before any decision is made to develop and deploy a defense, but also develop the technology base. Our ability to address the continually increasing Soviet capabilities rests with having a vigorous technology that validates the feasibility of our most advanced defense concepts. Balancing these competing needs in a well-defined investment strategy is the essence of the management challenge.

To meet our goal, we have defined a basic investment strategy with three major thrusts. First, we are bringing the most mature technologies to the point that if the decision were made to proceed, the job of developing and deploying the individual system concepts would be largely one of engineering. Second, we are pursuing the development of emerging technologies that have the potential for major improvements in defense effectiveness. And third, we are ensuring that an investment be made in innovative ideas that hold the promise of great success, although they present a higher technical risk. These innovations could yield a high payoff in achieving a thoroughly reliable defense.

Our intent has been to demonstrate technical feasibility of effective strategic defense and to provide a range of effective defense options to the President, the Congress, and the American people. We have made great progress in this regard. But while the Congress has increased SDI funding every year, the differences between what the Administration has requested to conduct a balanced research program and what the Congress has appropriated, are so large that if this trend continues, it will have a very substantial detrimental impact on the Program.

SUPPLEMENTAL

Large budget reductions from the FY 1985 and FY 1986 requested levels caused a reduction in the number of promising technologies being pursued in parallel and increased the difficulty of realizing adequate solutions to specific technical issues. We have been forced to cut back some of the validation schemes for many vital programs such as the Space Surveillance and Tracking System, Terminal Imaging Radar, Neutral Particle Beam and the Electro-Magnetic Launcher. I have attached a few charts to illustrate how each of the Program Elements absorbed reductions in FY 1987. Significant funding set backs have prompted the request for a supplemental appropriation of $500 million.

Specifically, the Supplemental is essential for the following reasons:

- partially restore midcourse discrimination efforts in Space Surveillance and Tracking System and the Neutral Particle Beam as well as other programs;
- partially restore ERIS, Space-based Interceptor, and HEDI interceptor technology validation schemes;
- improve the Ground-Based Laser schedule; and
- increase the investment in space transportation and space operations.

Furthermore, the supplemental request for Heavy Lift Launch Vehicle (HLLV) technology and system research has become an urgent national issue. The HLLV is essential to assist in assuming the nation's leadership in space. The Soviets, French, and Chinese are all developing robust space transportation systems. Our current space systems are capable of meeting only limited transportation needs. We must design a system to meet future mission requirements of the Department of Defense, NASA and our civilian space endeavors.

STRATEGIC DEFENSE INITIATIVE
FY 87 PROGRAM SUPPLEMENTAL

	($ IN MILLIONS)		
	FY-1987 APPROP	FY-1987 SUPP	FY-1987 REQUEST
SPACE SURVEILLANCE	135.6	25.0	160.6
MIDCOURCE DISCRIMINATION	52.4	45.0	97.4
SPACE BASED AND FREE ELECTRON LASER	142.0	13.0	155.0
NEUTRAL PARTICLE BEAM	52.5	10.0	62.5
NDEW UTILITY ASSESSMENTS & SUPPORTING TECHNOLOGIES	12.0	30.0	42.0
INTERACTIVE DISCRIMINATION AND FACILITY	13.5	17.0	30.5
SBKKV SYSTEMS AND FLIGHT EXPERIMENTS	96.0	35.7	131.7
EXO KKV SYSTEMS (ERIS)	4.5	10.3	14.8
ENDO KKV SYSTEMS (HEDI)	8.2	5.0	13.2
MINI PROJECTILES (EML/HVG)	20.5	9.0	29.5
COOPERATING SPACECRAFT SYSTEM (CSS)	10.0	26.0	36.0
SPACE-BASED BM/C3 EXPERIMENTAL SYSTEM VALIDATION	18.0	10.0	28.0
NEAR TERM SYS INTEGRATION TECH EXPERIMENT	3.8	4.0	7.8
LOW COST SPACE TRANSPORTATION	19.5	250.0	269.5
SURVIVABILITY	30.8	2.0	32.8
LETHALITY	0.0	3.0	3.0
POWER AND POWER CONDITIONING	28.5	5.0	33.5

COST

I would like to take a few minutes to address the issue of cost. Almost exactly one year ago in a hearing before this Committee I stated that one of the management challenges that I have tried to set for our Organization and for the people who will be implementing the program is to try to have set cost goals on key elements of the SDI Program over the next year. I am pleased to note that we have come very far in this area. I am prepared to address some of these cost goals in my vugraph presentation. I am not, however, prepared to give you an exact cost estimate of an SDI system because, quite frankly, it cannot be responsibly done.

The Soviet Union has estimated the cost of an American SDI system to be over a trillion dollars. Interestingly enough, they based their estimate on an SDI Architecture that was published in a report by a Washington based foundation. That Architecture has been discredited and admitted to be in error by the foundation in a letter to Congress as long as two years ago. A similar very costly estimate was made by the Council on Economic Priorities. While these unfavorable opinions are always accorded high visibility and exciting headlines, they are based on a fundamental misunderstanding of what we are doing. As an example, those estimates assume there is some generic SDI system regardless of the threat.

In contrast, our research program is pursuing various options: how many of what will eventually be deployed will depend on the Soviet threat, as well as on the success of our research. During my vugraph presentation I will provide an example of how a major element of our program is specifically aimed at cost-reduction, as well as reliable production and eventual operation.

I intend to provide a comprehensive report on the issues of cost estimates and cost goals for strategic defense as soon as possible. We did not submit a report with the Fiscal Year 1988/1989 budget request because the information necessary to prepare an accurate, comprehensive report is simply not available.

PROGRESS

We have received a great deal of support from the American public and are optimistic about the prospects for a well supported and successful technical program -- one with well-defined objectives that will allow us to carry out the mission assigned to us by the President. With that support we expect to realize the revolutionary capabilities and opportunities effective defense offers. Based on progress to date, I believe our optimism about the prospects for success is warranted. Let me mention briefly some of this progress.

First, we have made excellent progress with small homing hit-to-kill warheads. Their importance lies in the fact that they are of small size and volume and can be launched to high velocities either from a space platform or the ground with relatively small boosters and maneuver to hit the target. For ground-based lasers, advances in free electron lasers have opened the doors to initiation of a much more aggressive technical program to achieve high performance levels.

In addition, dramatic advances in particle beam accelerator technologies and the validation of a technique for determining the location of the particle beam in relation to the target have encouraged major new efforts for an early space-based experiment to demonstrate interactive discrimination.

A third key technology that we are pursuing is multispectral sensors and associated signal and data processing. These systems can act as the eyes and brains of a large complex set of actions and counteractions as well as providing an unprecedented view of where things are and what they look like. In doing so, they satisfy the demands of identification, discrimination, and decision-making for individual weapons.

Over the past year, sensor technology developments continued vigorously in five areas: radar technology, IR sensors, laser sensors, interactive discrimination, and signal processing. Several specific accomplishments are worth relating. Work has progressed on the installation of a real time discrimination system. This is the first system to demonstrate real time radar imaging of ballistic missiles. Secondly, the preliminary design for the x-band Terminal Imaging Radar was completed. This ground-based sensor will be capable of producing high-resolution images of a potential far-off target and will permit discrimination of warheads from decoys outside the atmosphere. Such radar technologies will be available for experimental validation in the late 1980s.

IR sensor performance improvements and radiation hardening are required for use by space-based surveillance and tracking systems. A critical support technology is the cryogenic cooling needed for sensitive IR sensors. A dramatic milestone occurred this year when our primary cryocooler design successfully demonstrated a five year lifetime, proving the feasibility of an active cooler for the long wavelength infrared surveillance mission. In addition, the integrated performance demonstration of the backup cryocooler design was also successful.

ALLIED PARTICIPATION

In addition to the many technological successes I have mentioned, we have also enjoyed great success with respect to allied participation in SDI research. Allied involvement in the SDI Program is very important if we are to realize the goals of the SDI in the most efficient and timely manner. There are several areas in which allied government institutions and private firms can make substantial technical contributions resulting in lower overall program cost and improved program schedule. Last year, contracts were awarded to governments or private firms in the United Kingdom, the Federal Republic of Germany, Israel, Italy, France, Belgium and the Netherlands. All SDI contracts to allied firms are awarded strictly on the basis of technical merit and cost, consistent with the competitive procurement practices mandated by the Congress.

Additionally, the SDIO, in compliance with its charter to perform research for defending against ballistic missiles of all ranges, is participating in a number of projects already underway dealing both with the concepts for theater ballistic missile defense and with the requisite technologies. Last year, the Secretary of Defense announced the award of seven industry contracts, three to allied prime contractors and four to U.S. prime contractors, for "Theater Architecture Studies." All of the work being done by SDIO is designed to be complimentary with a variety of other efforts in this area already underway within the NATO structure and under the Army ATM Program.

CONVENTIONAL DEFENSE INITIATIVE

I applaud the cooperative spirit in which the Services have embarked on the Conventional Defense Initiative (CDI). Even though -- as mandated by Congress -- SDI is not playing an active role in managing CDI funds, SDI research efforts, by advancing such technologies as computers, guidance and control, sensors, and kinetic energy weapons, will provide new and innovative capabilities for conventional forces. Both Initiatives are clearly beneficial to this nation's and its allies security.

ABM TREATY

Since the President's decision in the fall of 1985 that the broad interpretation of the Treaty is legally correct, the Administration has continued to review various other records and data on this subject. Additional analysis is being done on a priority basis -- reviewing negotiating records, ratification debates in the Senate, and the record of subsequent conduct by the two sides. Based on the work completed, the people responsible for this policy interpretation remained convinced of the correctness of the conclusion that the President reached in Fall 1985.

At the same time, it is clear that the conditions which the President found in 1985 have changed. As a result of the progress we have been making in SDI research, the balance is shifting between the price that the U.S. and its Allies continue to pay for voluntarily keeping our SDI Program structured within the bounds of the more restrictive view of the ABM Treaty and our overall security requirements.

A report on the impact on the SDI Program of legally correct interpretation versus the narrow interpretation of the ABM Treaty is being prepared by the Under Secretary of Defense for Policy with support from SDIO. We have been criticized for the extended delay in receiving this and other Congressionally-mandated reports. Unfortunately, additional work needs to be done that requires extensive coordinations. We are all working diligently to insure all requested reports will be ready as soon as possible.

As I stated earlier, one of the goals of the SDI Program is to provide a hedge against the real potential for Soviet efforts to exploit emerging ballistic missile defense technologies including complete breakout from the ABM Treaty. Possible U.S. defensive options to counter a Soviet breakout could include the use of kinetic energy weapon and sensor systems technologies to concentrate on the early portion (boost phase) of a ballistic missile's flight trajectory and could consist of space-based kinetic kill interceptors (high speed projectiles) combined with surveillance and targeting systems. A second, late midcourse, defensive layer could consist of ground-launched interceptors, combined with ground-based radars and ground-launched infra-red probes, to destroy nuclear weapons that have escaped the boost phase.

However, this cannot be the only response we have available to address this potential Soviet threat. If a defensive system is to have lasting value, technology and tactics must be available that would allow the system to evolve over an extended period to counter any plausible threat. This would ensure the system's military effectiveness, survivability and cost effectiveness in maintaining its capabilities more easily than countermeasures or proliferation could be taken to try and defeat it. These vital requirements to system effectiveness cannot be ignored in favor of a "quick fix". Any desire to limit the scope of a strategic defense system to near-term options only would severely undermine the potential offered by comprehensive, layered defenses.

At this point I would like to clarify an issue that has appeared in the media lately. The concept of phased deployment only addresses the question of how to deploy strategic defenses in the event a deployment decision is made in the future. The recognition that we must necessarily deploy defenses incrementally does not constitute a decision to deploy. An incremental approach is absolutely logical when one considers that no strategic defense deployment could be made all at once.

CONCLUSION

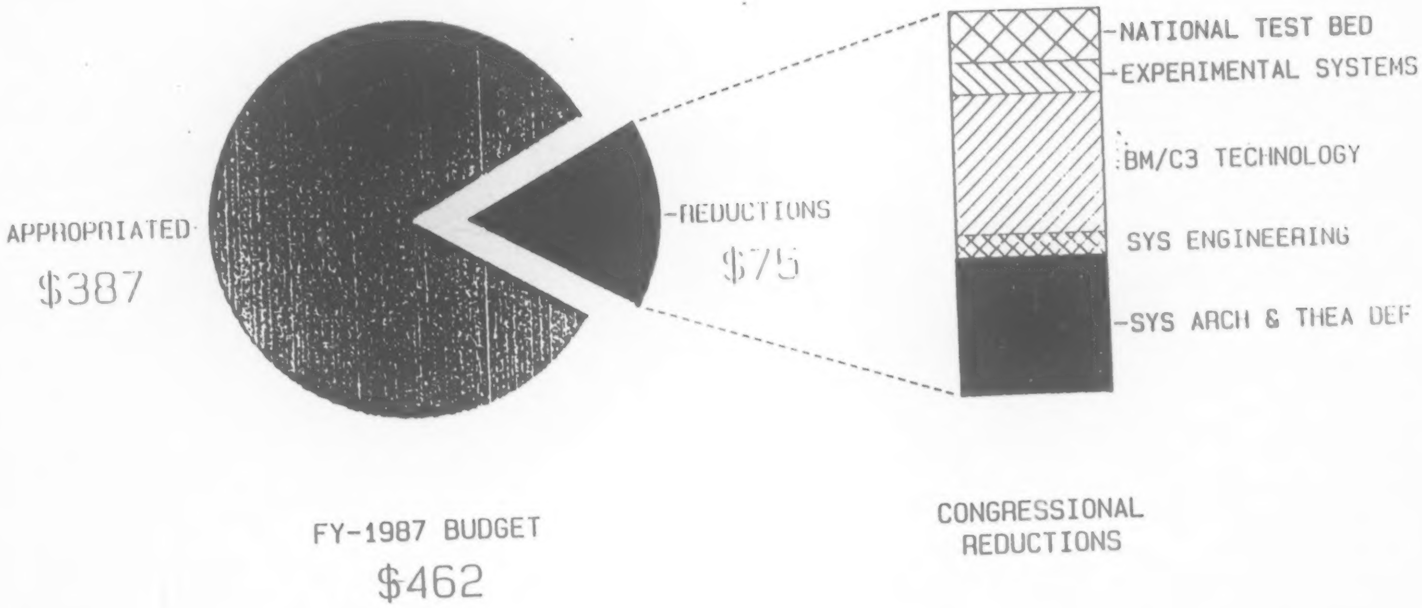
In summary, I would like to emphasize that we have remained resolute in our pursuit of the objectives set before us despite congressional refusal to fund fully the SDI budget at the requested levels. However, this goal is threatened by proposals to limit real growth to an annual three percent budget increase. Such limited funding will seriously affect the vital balance between development of a technology base and technology validation efforts essential to support a development decision. It will not allow us to keep pace with expected Soviet offensive and defensive developments. If SDI funding continues to be limited, the U.S. is not only going to waste its greatest leverage--the innovation only possible in a free society--but it cannot expect to do more than just react to Soviet initiatives in strategic defense. If U.S. efforts to pursue a thoroughly reliable defense are to be successfully carried out in a timely fashion, funding must be restored to levels that will allow the SDIO to pursue effectively options for ballistic missile defense of the U.S. and its allies.

The time has now come for the political and technical communities in our country to come together and agree upon a stable future course for the Strategic Defense Initiative Program. Our goal is both valid and appropriate, our systematic approach is sound, and our technical progress has impressed even the most severe critics.

The prospects for reaching this objective will continue to improve as our program proceeds to exploit emerging technologies. The fact that the SDI Program has already yielded impressive dividends which have met or exceeded our expectations in key program areas is testimony to the skill and enthusiasm of American and allied researchers, and, I believe, well justifies the considerable confidence of the American public, and the support of their elected Congress.

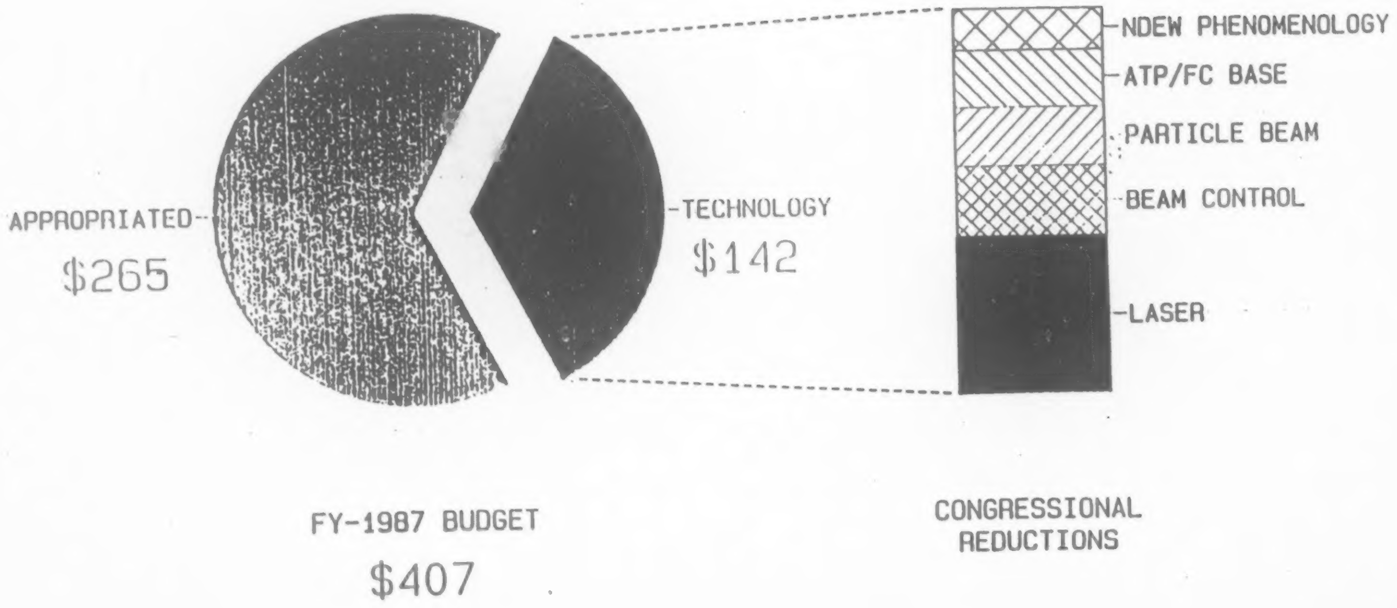
STRATEGIC DEFENSE INITIATIVE
FY1987 CONGRESSIONAL REDUCTIONS
SYSTEMS CONCEPTS AND BATTLE MANAGEMENT

($ IN MILLIONS)

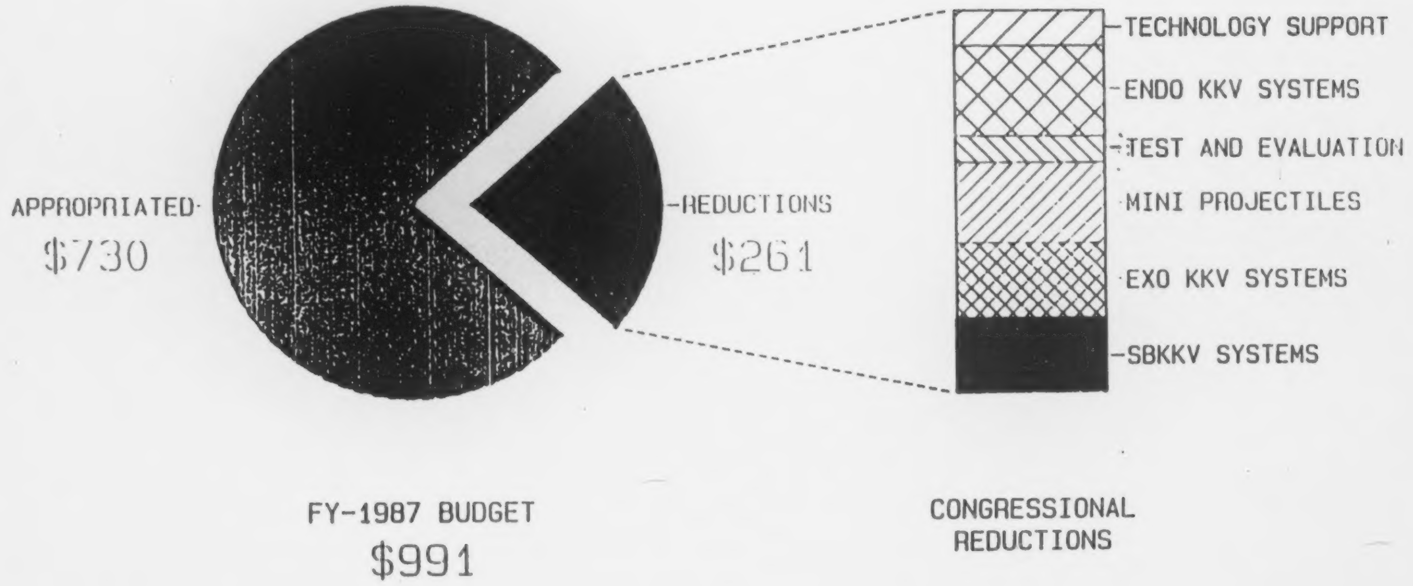


STRATEGIC DEFENSE INITIATIVE
FY1987 CONGRESSIONAL REDUCTIONS
DEW TECHNOLOGY

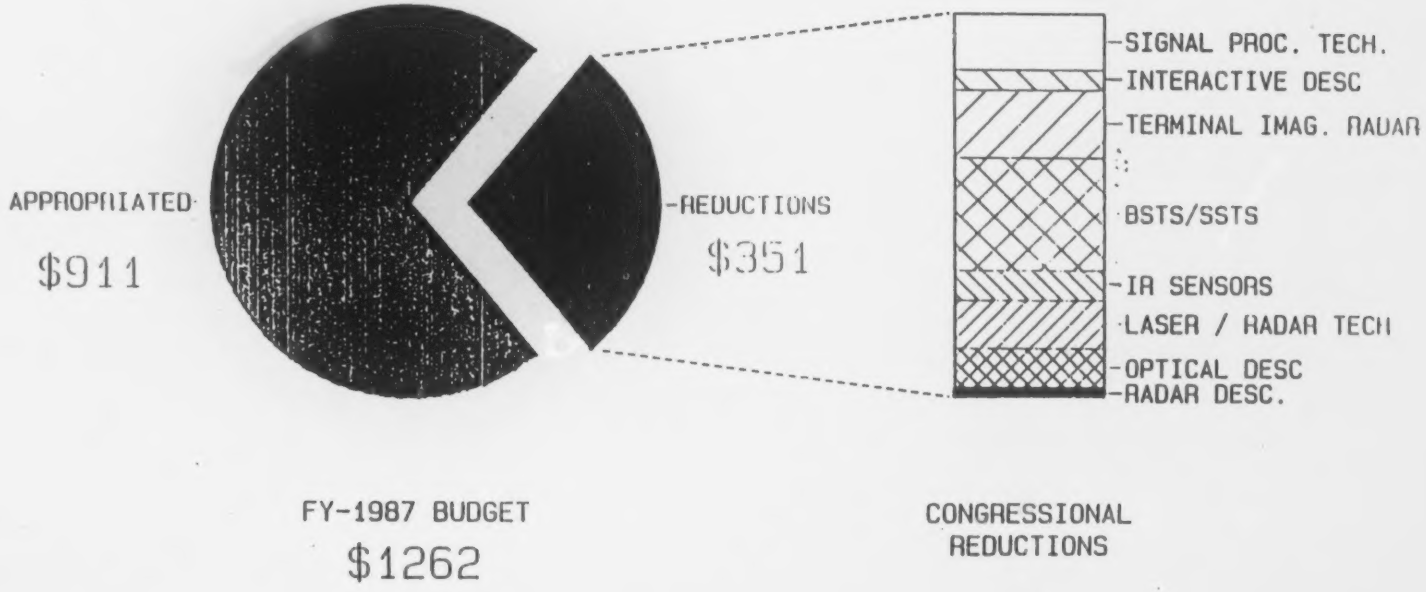
($ in millions)



STRATEGIC DEFENSE INITIATIVE
FY1987 CONGRESSIONAL REDUCTIONS
KINETIC ENERGY WEAPONS
($ IN MILLIONS)

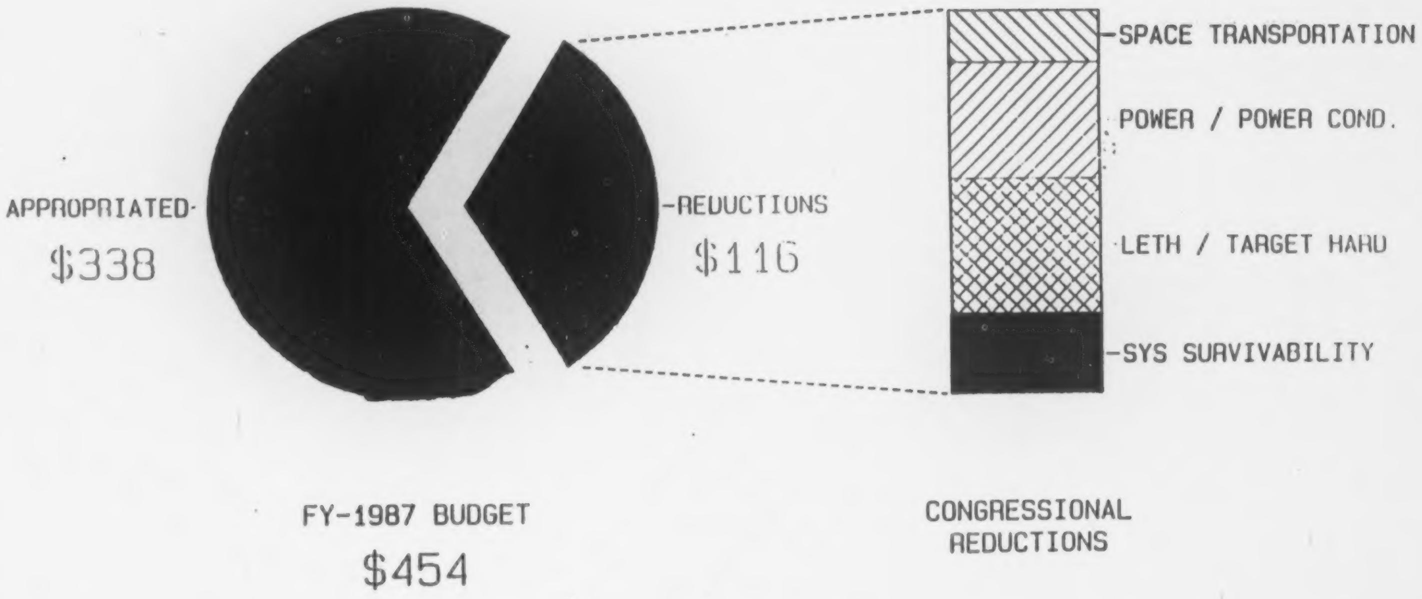


STRATEGIC DEFENSE INITIATIVE
FY1987 CONGRESSIONAL REDUCTIONS
SURV , ACQUISITION TRACKING / KILL ASSESSMENT
($ IN MILLIONS)



STRATEGIC DEFENSE INITIATIVE
FY1987 CONGRESSIONAL REDUCTIONS
SURVIVABILITY LETHALITY/KEY TECHNOLOGIES

($ IN MILLIONS)



PREPARED STATEMENT

Chairman STENNIS. For the same purpose, I have an opening statement here outlining the hearing, and I ask unanimous consent that that statement be placed in the record.

All right, without objection that is so ordered.

[The prepared statement of Chairman Stennis follows:]

PREPARED STATEMENT OF HON. JOHN C. STENNIS

U.S. SENATOR FROM MISSISSIPPI

Good morning. Today the Defense Subcommittee begins what will be a series of three hearings into perhaps one of the most ambitious and expensive military research programs ever undertaken by the Department of Defense—the Strategic Defense Initiative, or "SDI."

With us as the principal witness is the SDI Program Director, Air Force Lt. Gen. James A. Abrahamson, who has directed this complex and controversial program from its very inception almost 4 years ago. Accompanying General Abrahamson are Dr. Gordon Smith, Deputy Director of SDI, and their two top assistants responsible for all the major programs in SDI—Dr. Lou Marquet, the Deputy Director for Technology, and Brig. Gen. Malcolm O'Neill, Deputy Director for Programs and Systems.

Welcome again to the subcommittee, General Abrahamson. We look forward to your testimony, and to asking questions of you, and if necessary, your principal deputies and their top program managers who are sitting behind you.

Next week, on Tuesday, March 24, at 9:30 a.m., Ambassador Max M. Kampelman, the chief American negotiator at the Geneva arms talks will testify about SDI and related administration arms control perspectives. On Thursday, March 26, at 9:30 a.m., we will hold our third SDI hearing, with former Defense Secretary Harold Brown as our chief witness.

Ambassador Kampelman and Secretary Brown have unique expertise in these issues, as do you, General Abrahamson, and you all are highly respected by the Congress.

These three hearings should provide our subcommittee with valuable insights to inform our decisions this year on the size, composition, and direction of the President's SDI budget request for fiscal 1988 and fiscal 1989.

It is no understatement that the SDI program carries with it enormous implications for our military security, the size and composition of future defense budgets, prospects for reasonable arms control agreements with the Soviets, and relations with our allies, especially in NATO.

These are highly complex matters—highly complex—from both policy and budgetary perspectives, and while this subcommittee concerns itself primarily with budget issues, it is difficult to avoid discussing both perspectives, since they virtually are inseparable in the case of SDI.

From the budget and program perspective, the administration is seeking $5.2 billion for the Defense Department's share of SDI in fiscal year 1988—by its own calculation an amount which represents growth after inflation of 55.5 percent. The fiscal year 1989 request is for another $6.3 billion, which embodies another 16.4 percent real growth, according to the Pentagon. In addition, the SDI program is requesting a fiscal year 1987 supplemental of half-a-billion dollars.

These requests come after 3 years in which Congress has appropriated a cumulative total of more than $7 billion for SDI. The Federal deficit has forced Congress to trim SDI's budget request each year, but the program has received steady real growth annually, while many other defense programs have been constrained much more.

This year, the deficit pressures are even worse, and programs seeking major increases will receive particular scrutiny. Given its relative good fortune previously, SDI will attract a lot of congressional attention, General, so we need to hear your best justification for the new budget requests.

Also, there has been a major reorientation in the SDI effort in the past few months, with a much publicized push toward developing a space-based and ground-based ballistic missile defense system earlier than originally contemplated There are strong feelings in Congress for and against this shift.

General, we need to know the justification for this significant shift, what it means for the goals, direction, and composition of SDI now and in the future, and how all this impacts on present, and future, SDI spending requirements.

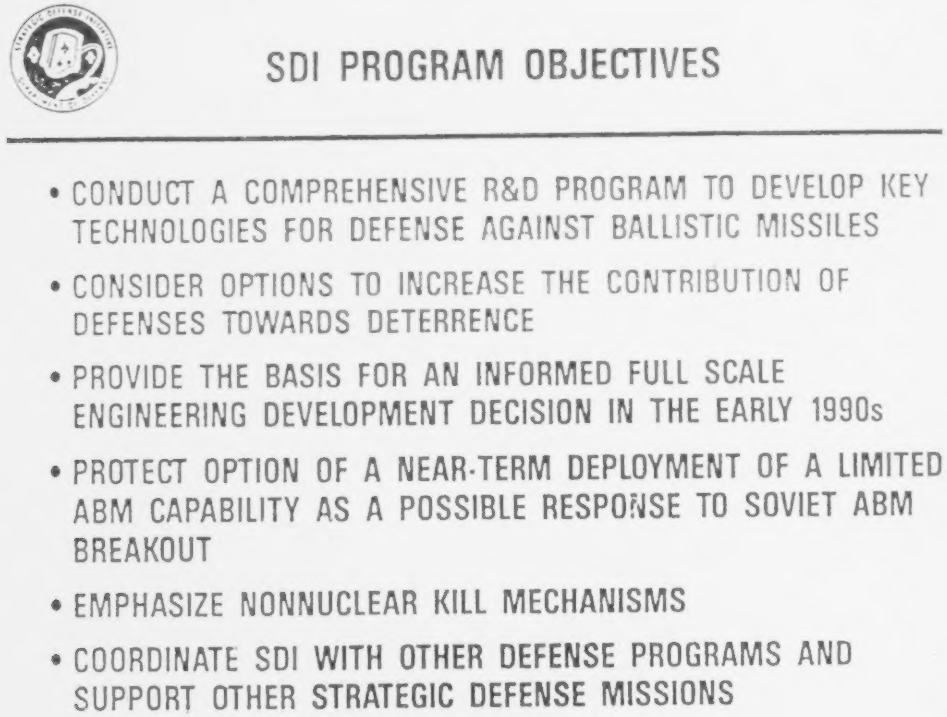
Finally, there is a policy question which also affects the cost, pace, and direction of SDI—whether the Anti-Ballistic Missile Treaty, the ABM Treaty—permits certain types of research on strategic defenses. This is an arms control issue which I am confident will be considered by the Foreign Relations and Armed Services Committees, but the subcommittee needs to know how this question impacts on the SDI budget and progress in the SDI program.

General, you testimony is highly relevant to Congress, and I hope you will give us a good look at all these issues and others which involve the SDI effort. Let me ask the distinguished Ranking Minority Member, Senator Stevens, if he has any statement, and then you may begin your testimony.

CONTINUING SDI R&D

Chairman STENNIS. You may proceed, General.

General ABRAHAMSON. I believe that it is valuable to go back to our presidential direction and our objectives; therefore, I will start here but I will not dwell on these.



SDI PROGRAM OBJECTIVES

- CONDUCT A COMPREHENSIVE R&D PROGRAM TO DEVELOP KEY TECHNOLOGIES FOR DEFENSE AGAINST BALLISTIC MISSILES
- CONSIDER OPTIONS TO INCREASE THE CONTRIBUTION OF DEFENSES TOWARDS DETERRENCE
- PROVIDE THE BASIS FOR AN INFORMED FULL SCALE ENGINEERING DEVELOPMENT DECISION IN THE EARLY 1990s
- PROTECT OPTION OF A NEAR-TERM DEPLOYMENT OF A LIMITED ABM CAPABILITY AS A POSSIBLE RESPONSE TO SOVIET ABM BREAKOUT
- EMPHASIZE NONNUCLEAR KILL MECHANISMS
- COORDINATE SDI WITH OTHER DEFENSE PROGRAMS AND SUPPORT OTHER STRATEGIC DEFENSE MISSIONS

PROGRAM DIRECTION

The most important thing to point out is that we have not changed one bit from the original direction in the program, and that is to conduct a comprehensive research program to develop the technologies to support a different strategy, one that provides options to increase the contributions of defenses toward deterrence, preventing war, and to provide a basis for an informed full-scale engineering development decision by the early 1990's. Obviously, we would like to do that as efficiently and as quickly as possible because the Nation has no defenses at this point in time.

There is a responsibility to protect the option for a deployment in case there was a Soviet breakout. That is my responsibility to plan for. It does not distort or change the priority of the program. Nonetheless, we do planning in that area.

BUDGET REQUEST FOR DOE

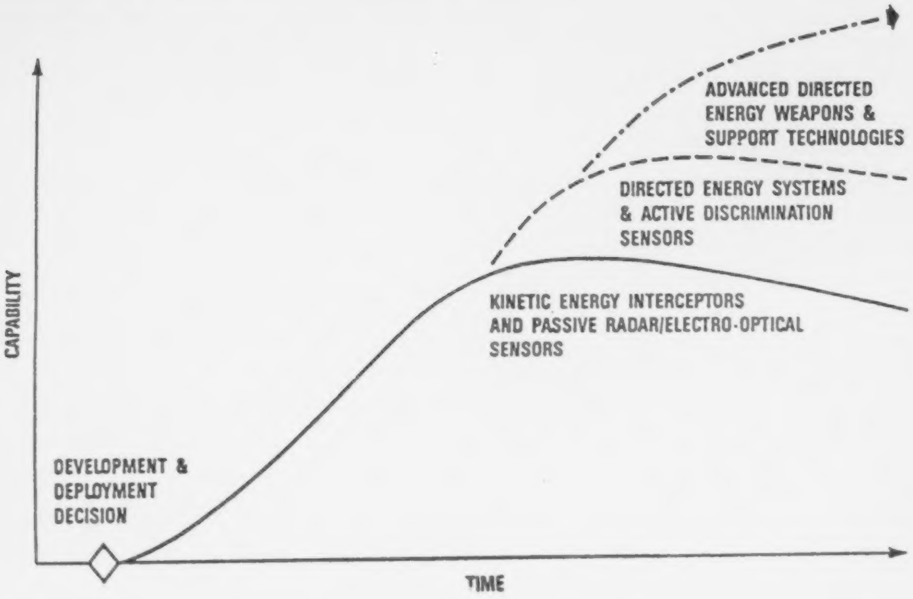
We are to emphasize nonnuclear kill mechanisms, although in addition to the budget request that you are examining, there is a budget request that is properly in the Department of Energy. It deals with some of the nuclear areas of the program that under the Atomic Energy Act should be funded under the Department of Energy. That examination is primarily because we know the Russians are working in many of these areas, and we do need to understand the threat that that involves for those kinds of systems.

We further have a responsibility to coordinate our program with other ongoing programs, and I believe what you will see is that the technology that we are creating here will indeed be useful in many areas of conventional defense and, frankly, in civil applications as well.

It is my responsibility not to spend money to develop those other applications but instead to identify them to the people who can use them and in that way obtain a second benefit to the taxpayer.

Next, please.

THE PATH TO "THOROUGHLY RELIABLE" DEFENSES



PHASE DEPLOYMENT AND EARLY DEPLOYMENT

General ABRAHAMSON. Now, some people have misinterpreted our discussions of phase deployment and early deployment as something that is dramatically new, and to try to relate what is happening now to what has happened in the conversations we have had in the past. This is a chart that we put together and showed in some committee hearings and also with many members and in many other fora.

As you can see, it had to deal with the fiscal year 1985 budget. We tried to divide the technologies into three categories. There are any numbers that you could use, but we essentially said that there are some mature technologies that are building on things that we have done in the past, missile developments, rocket developments, guidance developments. Those mature technologies will probably come first, and they should be exploitable first, and that when a development and deployment decision would come about, then that would be a gradual moving through that development process to a deployment process.

ADVANCED TECHNOLOGIES

A deployment activity would not be something that happens all at once. There is a logical, orderly way in which it would proceed, and that is the mature technologies would be the means of providing an initial capability of defense.

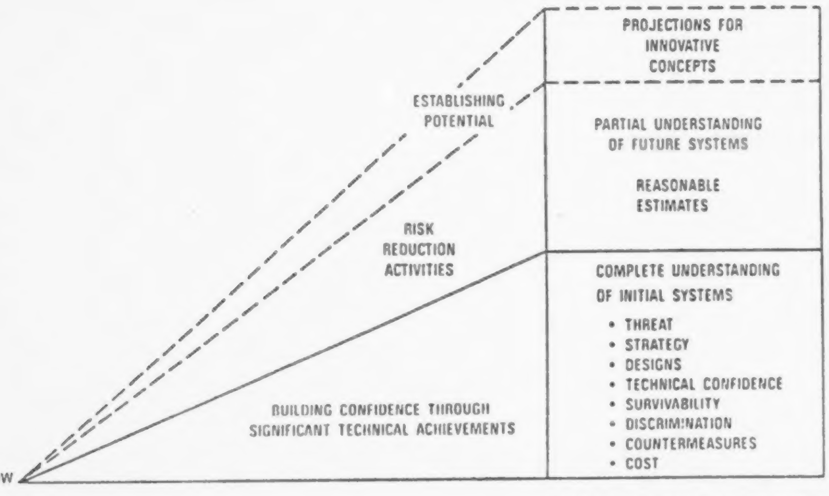
That initial capability would not reach the full challenge that the President has given us; therefore, we are also looking at advanced technologies, and here is where some of the lasers and the directed energy and the exotic concepts are really being perfected. They would not come along as quickly as a mature technology, so they could well be a second phase or a second generation.

Thirdly, we are looking at some very highly innovative ideas. We are not putting a great deal of money into those until we see that they really are necessary and have a great potential. Eventually, it would be those that would allow you to continue climbing towards the President's long-term goal.

So the idea of a phased deployment is not something new that we are introducing this year. In fact, it has been something that is a natural evolution of any technology development program.

Next one, please.

DEVELOPMENT DECISION CONTENT


PROJECTIONS FOR INNOVATIVE CONCEPTS
ESTABLISHING POTENTIAL
PARTIAL UNDERSTANDING OF FUTURE SYSTEMS
REASONABLE ESTIMATES
RISK REDUCTION ACTIVITIES
COMPLETE UNDERSTANDING OF INITIAL SYSTEMS
• THREAT
• STRATEGY
• DESIGNS
• TECHNICAL CONFIDENCE
• SURVIVABILITY
• DISCRIMINATION
• COUNTERMEASURES
• COST
BUILDING CONFIDENCE THROUGH SIGNIFICANT TECHNICAL ACHIEVEMENTS
NOW

- MAJOR POLITICAL DECISION
- FIRST OF SEVERAL

NATIONAL DECISION TO MOVE AHEAD

General **Abrahamson**. Now, I tried to look ahead to how, in fact, these decisions might be made. What is the nature of this important national decision to go ahead? I tried to relate that. This is an old chart from 1985 as well, again that I used in several of our hearings and in other fora. I tried to point out when it comes time to make that decision, we would have to look at initial systems with the same critical examination that you use for any weapons system, that we certainly need to know the threat, how it would be used, the specific designs, the technical confidence that we have in those designs, whether or not it will be survivable, how it will stand against countermeasures and cost, and we would have to have a great deal of detail for those particular systems.

Because we are looking ahead to a long-term program that will go beyond that initial capability, we also felt that at the time that initial decision were to be made you would have to have some detail, not the full understanding for the advanced systems but at least reasonable estimates for some of those advanced systems so that you have the confidence that when you take the first step you are going to be able to begin to take that second step. It is just a matter of more research and more dollars, but you have to have the confidence that you will not be stopped at the first step.

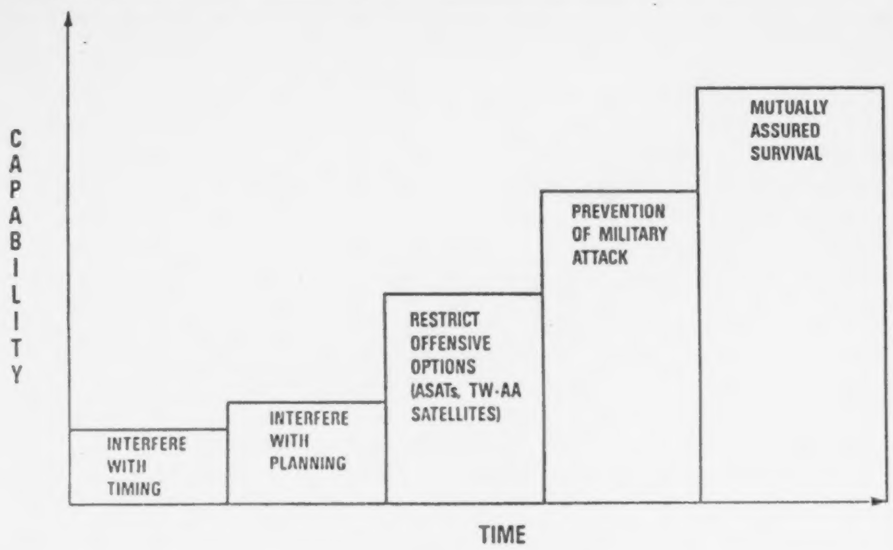
Finally, you need to know that there are some of those innovative concepts further on that will indeed offer you a means of someday achieving the thoroughly reliable defense that the President has outlined as a goal.

Now, that decision is not a single decision but a group of decisions. The first one, of course, had a major political strategic content, an implication; therefore, that was the one that was the most critical and that we would never be able to make that decision by bringing over briefings, no matter how effective or how many hours that all the members of the Congress and staffs would be willing to look at that. In fact you would have to gain confidence slowly by watching our program over time, seeing what we are achieving, so that when the components of that decision come to you for that national decision, what you would have is a history of confidence in the program so that it becomes a validated decision.

Otherwise, it will be too difficult to make because this is like embarking on the creation of a whole new concept, a new force. It is not the equivalent of deciding we want to build a more advanced airplane or an advanced submarine. It is clearly something very fundamentally different than we have ever done before.

So this was at least my own view of the nature and the timing and the sequence of these kinds of decisions in the future; therefore, I do not believe when we talk about phase deployment that we are introducing a new idea at all. We are, however, introducing a great deal more concrete analyses and, if I could have the next chart——

MISSION EFFECTIVENESS IMPROVES
WITH PHASED DEPLOYMENT



LAYERED DEFENSE

General Abrahamson. Last year as we presented our budget, time and time again I was asked the question that said is this something to defend people, or is this something to defend strategic targets. When I kept getting that question even from knowledgeable people, what that clearly said to me is that we were not getting our point across. I had not been effective in getting across what our real objectives were, and I believe that the people who listened truly understood the implications of a layered defense, the long-term implications, and that they must have been asking in that context how we were going to proceed in this step-by-step fashion toward the long-term goal.

We therefore went back over this last year, and spent a great deal of time saying that we should not begin a deployment merely because we are technically ready. That deployment, when that happens, whether it is early or late, has to be built on a fundamental foundation of real military contribution to safety, even the first step, and the steps should stand on their own by having a contribution as well as being a direct step moving toward the long-term goal.

INDEPTH ANALYSIS

So last year we started indepth analysis. We went through many conflict games, war games if you will, examining the value of partial defenses, and we began to get an insight. There is no way to prove this, by the way, but we did begin to get an insight into the value of partial defenses, the things that will be there quite naturally as you proceed toward the long-term goal.

Here are, in a very gross way, some of those kinds of military implications. They are military implications but they do add, and this is the important issue, stability in the overall deterrence equation because, after all, the first objective of such a system is to help us prevent war, to avoid it, particularly the nuclear aspect of war. Secondly, if somehow this terrible thing would happen that deterrence would break down, then to be able to protect both the people and the Nation and the institution that we really represent.

So if we could interfere with the timing of an attack so that a Soviet military planner could no longer have unlimited options for a surprise attack, for a first strike, for a decapitating attack for our command and control structure, we thought that would add substantial capability in terms of adding to deterrence and stability.

If, further, we can confuse, even with a thin defense, the limits on his ability to structure any kind of an attack, for example, interfere sufficiently with his heavy strategic rocket forces, the SS–18's and the others which really are the fundamental backbone of their strike force capability, that indeed we would introduce such an element of uncertainty that we would limit their attack options. By doing that, again, we would add to stability and add to their uncertainty in a way so that when you combine our offensive capability now, our deterrent, with a partial defense, a thin defense, some defense capability, that we end up with increased safety. Later on as you begin to build up the area on this chart where we depict a very robust defense, perhaps a long way from a perfect defense but still a robust defense with many, many layers fully in place, then we can be at a point where we can maintain our security and our prevention, our war prevention posture, our defensive element of deterrence, which becomes a major ingredient, and the offensive element becomes a much smaller ingredient.

In that sense, we could proceed with confidence into some of the arms control regimes that we are all working toward to reduce the number of offensive arms on both sides and still maintain the confidence that the nation would be safe in case of surprise attacks or fundamental and quick changes. Even then, the research program should always be working for the long term.

So we think there is a logical sequence. That military contribution, which is a contribution in defending both people and strategic targets because we are aimed at destroying ballistic missiles wherever they may be targeted, has been the subject of intense examination this last year. It is not done.

PHASE DEPLOYMENT

The Joint Chiefs of Staff and the individual services are examining now the structures, the strawmen that we have put in place, and that is where all of the emphasis and the discussion on phase deployment has come from.

What is their best military judgment on the size and shape of one of these first phases of a deployment, whether it is early or late, so that it really does have this meaningful military contribution to our security, that process is not done, but out of that and misinterpretations of some of the comments that have been made has come, I believe, this large debate on early deployment.

DEFENSE ACQUISITION BOARD REVIEW

Now, that does not mean that we are not trying to move this forward as fast as possible. We certainly are. We need judgments by the entire Department of Defense. We are now embarked on what we call in the normal acquisition process in the Department of Defense. We are starting work on a milestone part—it used to be DSARC, now it is called the Defense Acquisition Board Review—in order to have that validated level so that there is a complete understanding and agreement with the concept of phase deployment.

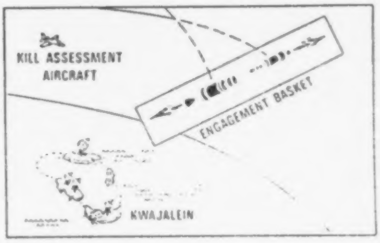
Now that phase deployment does not take away from the fact that there is still a second policy decision that must be made. That second policy decision essentially is how early should that decision be made or how late should it be made, and has the technology reached the maturity so that we really have the affordable options and that we meet the criteria that were laid out from the very beginning by the President for each phase of such a deployment.

So I hope that that provides you some perspective in not only what we are doing, but now I would like to concentrate on some of the systems. There has been so much controversy about the exotic systems in the past that we have been making a great deal of progress in, not dramatic scientific breakthroughs, just good solid engineering progress.

I said all last year, that we were putting the work in place brick by brick so this decision can be made, and that is exactly what is happening. Again, please do not misinterpret the fact that I would now like to take a slice across some of the mature technologies and comment on those that we have unbalanced the program. In fact, there are more resources going into the long-term efforts than there are the short-term efforts. Nonetheless, it is not as much as we really like and need in either of those areas.

Next, please.

DELTA 180 SPACE EXPERIMENT – SEPT 86



- FIRST PLUME MEASUREMENT IN BOOST AND POST-BOOST PHASES
- FIRST VALIDATION OF LOW-COST TACTICAL SENSORS IN SPACE
- FIRST SPACE LASER RADAR
- FIRST SPACE-BASED THRUSTED APPROACH
- UNPRECEDENTED NUMBER OF REAL TIME DOWNLINKS

DELTA 180 EXPERIMENT

General ABRAHAMSON. One of the important tests that we achieved over this last year and one that gave us a great deal of confidence, and which illustrates the importance of being able to do tests, was what we call the Delta 180 experiment.

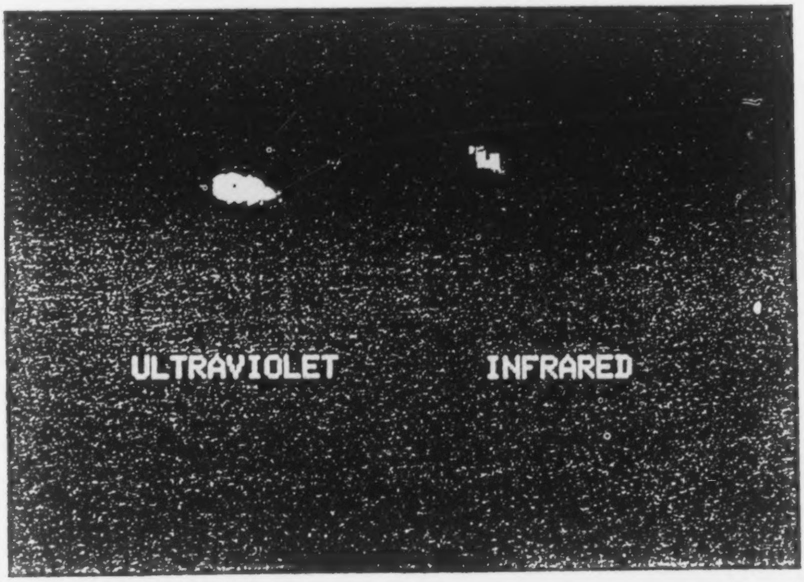
In this experiment, conducted fully within the restrictive interpretation of the treaty, we intercepted an orbiting body but one that could act like and give us the information so that it would appear to be similar, analogous, not a perfect analog, but analogous to the upper stage of a Soviet ICBM while it was thrusting.

I told various committees last year and individuals that one of the major areas of uncertainty in this whole program is what does one of these thrusting boosters really look like, what is its signature, not from a long distance away but very, very close, because we are trying to build interceptors that have to hit it. They have to hit a very, very small target. If they miss, if they are confused in those last few seconds, then all of the technology and all of the work and all of the systems that got them there would have been in vain.

What this experiment offered us was an early ability to see very carefully what that thrusting booster looked like with a series of viewpoints, look at it with different eyes. We look at it with the visual part of the spectrum. We looked at it in the ultraviolet part of the spectrum, in several of the infrared parts of the spectrum.

May we have the next one, please?

UV/IR MID-BURN IMAGES



General ABRAHAMSON. Here is a picture of images in ultraviolet and in infrared. The specific ranges of all of those, of course, are very, very sensitive, so that is classified.

Next one, please.

TECHNOLOGY EXAMPLE SPACE BASED INTERCEPTOR

SPACE EXPERIMENT

General ABRAHAMSON. The important thing is we got data that we can translate into an understanding of what these things look like, and that translates into confidence.

Now, we did something really dramatic here, and the teams of people who did this, I think they deserve just the highest credit possible because we conceived this experiment around the table in my office, and we successfully carried out one of the most complex space experiments ever 14 months later. Now, that has not been done in modern times.

We did that because of the incredible can-do attitude of people both in government, in NASA, in the Air Force, in the contractors, a whole range of contractors, and essentially, we used existing equipment. The guidance signal for this came from a Phoenix air-to-air missile, something that costs only a few hundred thousand dollars. That is not what we would do for one of our systems, but it demonstrates that in fact there are low cost options that, once worked on and perfected, really are possible.

SPACE-BASED INTERCEPTOR

Now, what I have here is more in line with what a space-based interceptor might look like [indicating to model], and I would like to try, again in the theme of going in depth across one of these programs, to talk about that space-based interceptor. This is only a mockup, of course. It is not a real one. Notice it is about as tall as I am. We would hope to be able to build one of those things at somewhere less than 200 pounds. Maybe the first version might be a little bit more than that.

If this were successful, and I would like to begin to make the cost effectiveness ratio here, although you must consider more than only the cost of the interceptor. There is other infrastructure that has to go in place, and I will comment on that.

If that were successful, that small missile could destroy an SS–18, something which is a huge investment on the part of the Soviet Union with 10 or more warheads, with a huge infrastructure of silos and people and construction battalions that support the deployment of that particular effort. This is not proof by any means of the cost effectiveness of these ratios because you must also consider on our side not just the cost of the interceptor but also the cost of the satellite that contains it, the warning satellites that are there.

It is not an unbalanced kind of situation as many of the people who have dealt with this consistently, simplistically, day after day in the press and in many other places have pictured it. I will try to explain that and show that as we go.

The challenge, of course, is to be able to make the front end of that, because here is the destruction mechanism, this one little piece of it about that big. That is the part that crashes into the SS–18 in the boost phase or perhaps in the postboost phase, after the boost phase is burned out and the upper stage is in the process of spinning off their warheads. That is the thing that destroys it.

It has no warhead, no nuclear warhead. We are considering putting on a net similar, slightly different but a similar concept, as we put on the homing overlay interceptor just to give you a larger kill rate. Nonetheless, it has no explosive power, and the intent is to make it as light and as small as possible. That is the challenge, not that there is something that is impossible here. Obviously, survivability is an issue.

Now, I have several charts. Notice here is the garage. Here is part of the thing that is the additional overhead associated with putting these interceptors in space, and of course they must survive. That garage might be loaded with interceptors on the order of 6,000 to 7,000 pounds, not a huge, huge satellite of some kind. There are several variations with different architectures, but it might have five or 10 or 15 or 20 of these interceptors in them in order to be able to operate. It is intended to be fairly simple.

Chairman STENNIS. General, if you could let me interrupt just a minute.

General ABRAHAMSON. Yes, Mr. Chairman.

SURVIVABLE SECTIONS OF SDI PROGRAM UNDER FISCAL 1988 BUDGET

Chairman STENNIS. Let us nail down some of these figures here as a starting point for you. These hearings will run several different days, and we need a starting point on this money matter now. I think the amount has already been appropriated heretofore by the Congress. It is just over $7 billion in the last 3 years for SDI.

Now, more in detail, we need to have the specific reasons for these increases that you are requesting, these amounts for fiscal year 1988 and fiscal year 1989 and why you cannot work with a lower steady growth. That might become an important point.

What are your most important programs, for instance, priority-wise, and what would be the impact of any funding cuts on SDI this year? I remember last year it was reduced.

Now, how would your research be delayed, and what does that mean for confidence in your work? What projects would you be forced to end which would be unwise to terminate? If you cover that some, that will give us a starting point on this money question, the dollars, and we can work from there.

If you are not prepared to do it right now, why we can pass your answer over until you can supply it for the record.

General ABRAHAMSON. Yes, sir. I would like to supply the total answer for the record, but if I may begin to address it, why the build-ups are so important now in the context of this one project, because I think that that illustrates for you why it is that the overall program which has many of these projects is really beginning to ramp up so dramatically.

Here is our funding in 1986 for this project, the technology effort behind the space-based interceptor and how it goes forward over a 5-year period. You can see that in 1986 we allocated both in terms of an experiment, in terms of concepts and some integrated technology work, and I will show you examples of that, and then in terms of advanced technologies a budget that was fairly large, $134 million. There is a reason why it was that large, and I will try to show you so that you see the scope of the effort.

Last year's budget cut was so dramatic, 36 percent out of what we had requested. I have to also say obviously it also represented an increase over the year before, and that was one of the few programs that got that, so I would be unfair if I did not acknowledge that not only this committee but all the committees worked very hard to allow us that increase.

It did, however, dramatically change our planning and, in fact, in 1987, we should have started on this program with a fairly dramatic buildup more substantially up on the $160, $170, perhaps $180 million kind of level, and we were forced to reduce the program below what it had in 1986.

[The information follows:]

SDI BUDGET REQUEST

- The SDI budget request supports a balanced research effort: a balance between technology base research and validation experiments, between ground and space based systems, and between mature and advanced technologies.

- In the past, budget reductions were implemented by eliminating competing technology approaches and delaying certain efforts. While these steps increased the risk to program success, the overall objectives were not substantially degraded.

- The options for implementing substantial FY 1988 budget reductions, while maintaining a strong technology research program, are limited to: reduce integrated experiments and/or shift from the balance between mature and advanced technology. Either of these steps would have severe impact on determining the feasibility of strategic defenses and would result in a delay in the time when a defensive system could be operational. The following actions would be necessary to implement budget reductions in FY 1988.

o $4.5B. Sufficient funds would be available to continue a balanced approach to both mature and advanced technologies. However, an informed decision on the feasibility of strategic defenses date could be delayed about two years because of delayed integrated experiments. Specifically:

-- Delay key satellite sensors experiments,
-- Terminate significant portions of endoatmospheric missile tests (HEDI) and theater defense programs.
-- Restructure two major directed energy programs to ground based technology only.
-- Space power programs (SP-100) delayed two years.

o $4.0B. A strong technology program is still possible. Funds would not be sufficient to continue essential Treaty compliant integrated experiments in both space based and ground based components. Specific changes:

-- Space Surveillance Satellite delayed one year; Airborne sensor restructured to a ground simulation; Experiment for terminal phase radar terminated.

-- Ground-based Free Electron Laser delayed 1-3 years.

o $3.5B. The technology base program would be reduced to addressing critical system and technical issues only. All initiated technology integration experiments would be delayed for two years. The time in which a first phase defense could be operational would slip a minimum of 2-3 years. Specific impacts:

-- Reduce Boost Surveillance Satellite and Airborne Sensor to ground-only experiment

-- Cancel Space Surveillance Satellite and terminal phase radar experiments

-- Delay Kinetic Kill Vehicle flights beyond planned date of FY 1990. Delay exoatmospheric missile testing (ERIS) to FY 1990. In addition a cancelling phase II of endoatmospheric missile, even initial research would be significantly slowed.

-- Delay Ground-based Free Electron Laser 1-3 years.

-- Cancel all system development efforts for the Advanced Launch System. Significantly slowdown SP100 development efforts.

o $3.0B. Under this funding level, it will be necessary to cancel virtually all major Technology Integration Experiments which have been initiated. The time in which a first phase defense could be operational would slip by more than 3 years.

-- Further reduce Boost Surveillance Satellite and Airborne Sensor technology efforts.

-- Cancel Space Surveillance Satellite and terminal phase radar programs, further reduce the probability of their reinitiation at a later date.

-- Delay Kinetic Kill Vehicle flights beyond planned date in FY 1990

-- Cancel all Survivability and Lethality system development efforts

-- Funding at $3.0 billion or below is tantamount to "research forever" without receiving an answer on feasibility

- A fundamental element in the overall strategy of a balanced research and technology validation program is the opportunity such an approach offers us to exploit our intrinsic high technology advantage to leap frog potential Soviet countermeasures. In a research only, or predominantly research mode, it is quite likely that Soviet progress in countermeasure development will keep pace with any potential U.S. strategic defense system.

BUDGET REDUCTION

Chairman **Stennis**. Reduced it to what, to identify it, reduced it to $134 million?

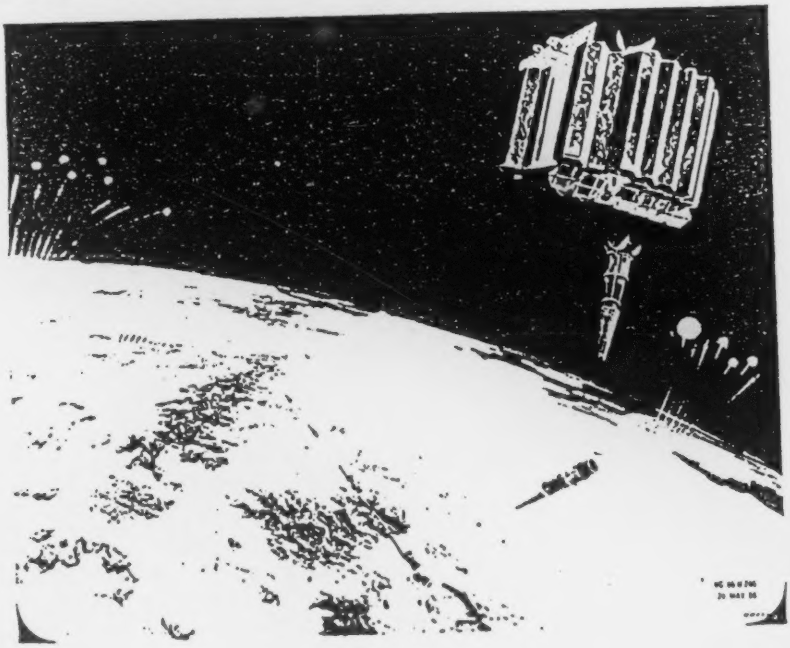
General **Abrahamson**. Reduced it to $127 million is what our planning number is now as we go through this year.

That delayed several things. It delayed moving into the system work. It also delayed some of the technology. We are now ready, however, to move into integrated technology activities. We have a request for proposal on the street, and we have companies bidding for this. If you cannot begin to assemble the technology to do the testing on the ground and eventually the testing in space, you will never have the confidence to make the decision, and I will try to show you why. Then it begins to build up fairly dramatically in that outyear period.

Now, if I could show you what we have accomplished with the 1986 and the 1987 money and why we feel we are at this point in this program.

Next, please, and let us go back to the technology chart.

SBKKV



SMALL TECHNOLOGY ITEMS

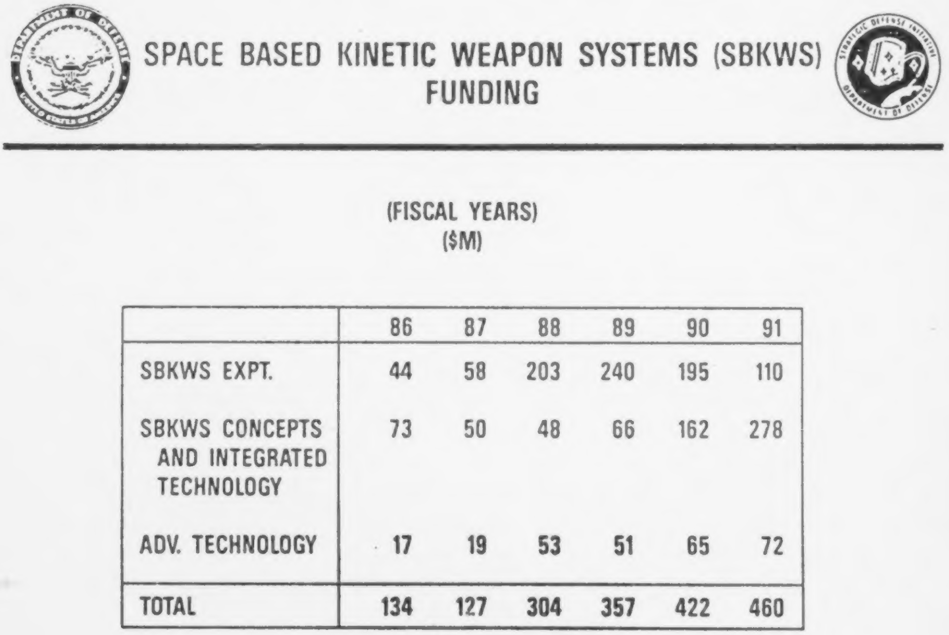
General **Abrahamson**. I have provided to the committee a handout, a book that explains how it is that we are investing in small items of technology, and I have some here right in front of me as well. Let me just try to relate to the slides, and then I think I can make it more dramatic right here.

The front end or the seeker, the eyes of this kind of system, must be very, very small and low weight in order to accelerate it to the very high speeds that we want to make it go. So, therefore, we really worked very hard on miniaturizing and on beginning to solve the command and control problem by distributing the command and control elements down to each part of the system.

For example, up in the upper lefthand corner here I have focal plane arrays. Now that is the eyes of the system. We have several different contractors who have already produced and tested eyes that are very, very small and approaching having the characteristics that we want.

We have front ends of these systems that we have tested on laboratory tables by themselves, front ends to see that they have the right characteristics, electronics so that we have worked out and tested again this command control part, but we have not miniaturized yet.

Go to the next one, please.



SPACE BASED KINETIC WEAPON SYSTEMS (SBKWS) FUNDING

(FISCAL YEARS)
($M)

	86	87	88	89	90	91
SBKWS EXPT.	44	58	203	240	195	110
SBKWS CONCEPTS AND INTEGRATED TECHNOLOGY	73	50	48	66	162	278
ADV. TECHNOLOGY	17	19	53	51	65	72
TOTAL	134	127	304	357	422	460

SIDE THRUSTER ENGINES

General **Abrahamson**. Now let me give you some, I think, understandable kinds of efforts. These things must be able to not only be thrust forward at very high speeds, the missile must be able to make corrections as it comes right in and intercepts. It has to make dramatic corrections, so it has to have motors like this that fire sideways and that fire powerfully so that it can move quickly and then crash into the booster.

Now here are some of the kinds of research and some of the payoffs from that research. Here is a way in which we are developing very low-cost methods of manufacturing these side thruster engines. It is an idea that was taken from the shuttle program, is now being perfected, and we have fired these systems. These are 50-pound rockets all put together, made from these little stamped out pieces of steel. They are not steel. They are really very, very proper alloys, difficult alloys. Then they are welded together so that these rockets will be very low cost and very lightweight. That is one concept for the side thrusters.

Here is another example. This is a small attitude control thruster that is on one of our communications satellites today. It represents pretty good technology today. It fires about a pound of thrust, not very much, just enough to tip the end of this thing or to change the attitude of the satellite.

Here is where we have taken this and reduced it down to this tiny, tiny thruster that size to decrease the cost and to make it small and effective. Now that kind of research is going on throughout this entire program. In this particular interceptor, this is one that uses liquid fuel propulsion in order to make it go very, very fast. You want to make it go fast enough so that you can reach over a very great distance and be able to destroy that booster quite early on its flight up.

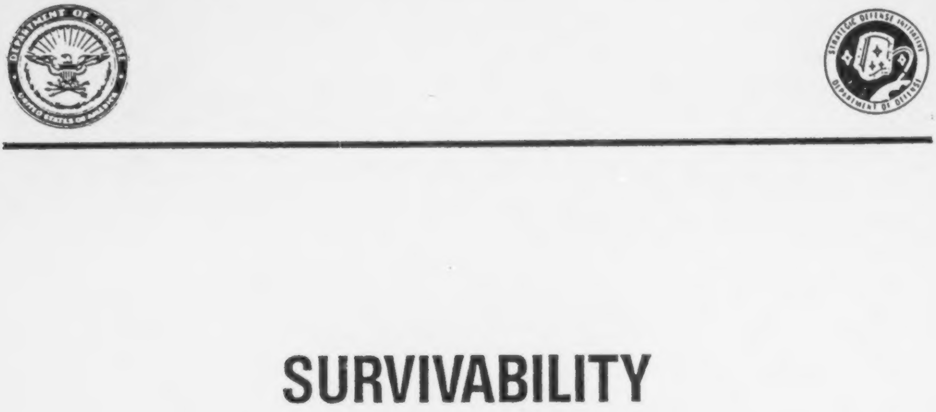
Now that is pretty simple. That is today's technology. That is not very difficult, but I have to be thinking about the logistics of this kind of a system in today's technology. We have to be able to get the fuel out of that tank and back into the rocket motor here quickly and under tremendous pressure. For the kinds of rocket motors we use today, we use flexible diaphragms in here. They are not rubber, but they are flexible diaphragms in order to push this thing out very quickly. There is a high gas pressure that comes through.

Now, that is adequate for today's rockets but, if this sits all by itself up there and is not used for 10 or 15 years, those kinds of flexible materials will be eaten up by the very corrosive material that we have as the fuel.

So here is where we have taken these current systems and we have made aluminum diaphragms, these kinds of diaphragms that push through very quickly, that do several things. It will last a very, very long time. So we have to think about the long-term logistics of such a system.

Now, this does not cost very much, and we have done it already. We have made it with these aluminum kinds of systems. We have done that in such a way that we are taking a very little step of making this work, but now we have done most of it. We have done the testing. We have miniaturized the systems.

Could I have the new one?



SURVIVABILITY

SMALL INTEGRATED SYSTEMS

General ABRAHAMSON. Now we are ready to put integrated systems together which then can be tested out somewhere in the 1989–90 timeframe in terms of they are not the development vehicle at all. We are not trying to give them all of the characteristics of the development vehicle, but we have to show that it is cost effective; therefore, we have to show that we can make it small enough and that we have mastered the technology to go ahead.

Here is just another example [indicating the model]. This is a little tiny ring laser gyro. It is about the size of a quarter, and that has been developed for the guidance system on this. That can be used not just on this program but in practical missiles for air-to-air-combat and many other applications in our other systems. So that is how we are moving the technology forward, and it can be used in the future.

SURVIVAL OF SYSTEM IN SPACE

Even if we could make it very low cost and even if it could be effective, the legitimate question that people ask, can such a thing survive in space, because there will be many of these garages up there, and it has often been described again by the people who take the argument in a simplistic way and say, look, here is the satellite, and they imagine the satellites that we have today that is always going in the same orbit, and all they have to be able to do is hit it with an antisatellite system of some kind.

So I would like to take just a few minutes and begin to show you that it is not that simple kind of a characterization that has often been used.

Next, please.

Chairman STENNIS. All right, General. Let me say you get some time here now to make your showing, and I want some time then for these members who have deserted other duties to come here and hear this testimony, and we want them to come back to future meetings. You have got to show your plan basically, and I want you to have a chance to. Then I propose to call on the members that are here and start off with dividing up the time way, say 8 minutes or something like that and see how it works.

General ABRAHAMSON. I will try to be faster, sir.

Chairman STENNIS. All right. I am not trying to rush you, but time is all we have. Do you want 10 minutes, 15 minutes, 20 minutes to make that basic showing now?

General ABRAHAMSON. Yes, sir. I think that I can do it in 15 minutes or less.

Chairman STENNIS. All right, just see how you make out.

[VUGRAPH 11 CLASSIFIED]

SOVIET INTERCEPTION OF GARAGES IN SPACE

General ABRAHAMSON. What this is is the problem of intercepting one of these, not this interceptor but the garage that it is in, and that is what people talk about. It is not, again, this simple one that people mention very often because if the Soviets were going to try to stop the system of these garages in space and they would be coming over the Soviet Union, I will show you it is not one, it is many of them. It is a whole line of them.

We are not using today's threat. We are projecting threats that we think are much more significant, and I will try to show you that they would have to be able to get their SS–18's or their other systems out through such a system. That means they have to be able to destroy those at exactly the right time. If they try to destroy them too early, we have unequivocal warning in this country. Our entire SAC force gets off. All of those kinds of things get off, and there is a very careful relationship between that warning that we get and making a surprise attack impossible.

Now here is a time line. We believe that we could see enough of one of these attacks coming that we could make a decision to commit these things in about 70 seconds. If it is one or two or three, you have a system up there, you have confidence, and you can wait all the time you want. You can wait 20 or 30 minutes longer than the President has today to make a decision on whether or not he is going to make a nuclear response which is very different than what he has here because his only decision is do I shoot at whatever, the one or two rogue missiles or potentially a space flight that has gone off course.

If you see a thousand missiles coming up out of the Soviet Union, you do not need much consultation. You want the system to react. We believe under those kinds of conditions you could react in 70 seconds or so. The first of these garage satellites would be up here and would fire quickly, and fire so that the first intercepts begin to be made at about 150, and they would continue to be made out to around 250 or 260 seconds. Some of them would come on later on as well.

The Soviets, in order to stop that, would have to have destroyed that particular satellite but not just that one, the one coming behind it and the one behind that and finally the ones that are clear down over the Indian Ocean and for ones that are coming over the North Pole, ones that are way over Canada and not over the Soviet Union. It takes some time to fly up there.

So, the kinematics are not as simple as "here comes an ASAT that is going to knock out the system." There are real orbital mechanics that have to be considered.

[VUGRAPH 12 CLASSIFIED]

Now, let me go further just recognizing the time problem. Here is an unclassified view of the Soviet Union, and here are representative places where their missiles are. Here would be a line of those satellites coming down. At the time that they wanted to strike, they would have to have their ASAT's around the outside of the Soviet Union. They cannot even put them in the right place for some of them, because the right place is down in the Indian Ocean and not over the Soviet Union.

Next one.

[VUGRAPH 13 CLASSIFIED]

General ABRAHAMSON. These would represent the ASAT's coming up, and the important thing to know is that this carrier vehicle would destroy. This is its kill zone here for these boosters, and it is well ahead of the carrier vehicle. Remember what I said. By the time the ASAT's get to that one, they would have fired all of the interceptors on that one out, and it is like hitting an empty silo. It does not really do them any good.

Next one.

[VUGRAPH 14 CLASSIFIED]

General ABRAHAMSON. But that is not the only one. There is a whole line of them coming down. There is not just a single line coming down over the Soviet Union.

[VUGRAPH 15 CLASSIFIED]

General ABRAHAMSON. There are two lines, one line coming down and another line coming up with overlapping capability, and it is not just two.

Next one.

[VUGRAPH 16 CLASSIFED]

SATELLITE SURVIVAL

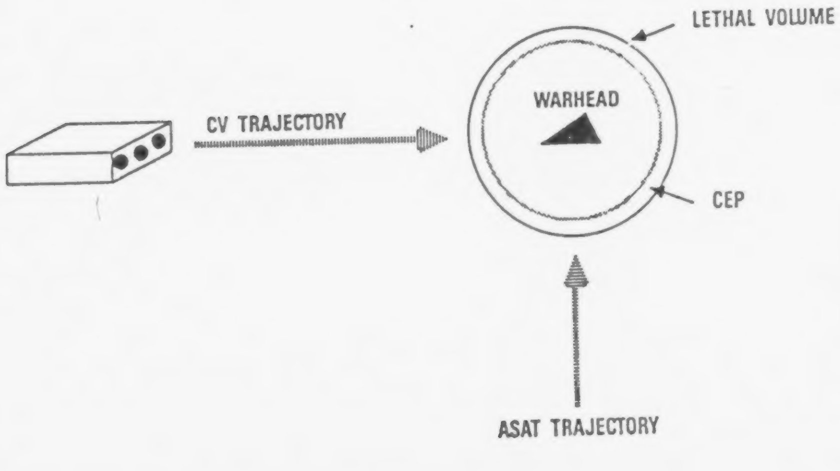
General ABRAHAMSON. In fact, there are many of these lines, so what you have is a very dynamic situation going on at all times over the Soviet Union. If they were able to knock out one or two, that might mean that a few missiles would get through if they could get it at the right time, and the destruction zone for those would be a long way away. It is not that every satellite has to survive. What has to survive is the formation, and it is a self-healing formation that comes in and closes up with the other ones that come through.

[VUGRAPH 17 CLASSIFED]

General ABRAHAMSON. Even so, we have to consider did we find a way through our tactics or through the design so that in fact those satellites will survive in a peacetime situation in case the Soviets decide they are going to challenge you as well as in a wartime situation.

Now, let me go back to the one-on-one situation just so you understand a little bit about what they might do.

ONE ON ONE ATTACK-1



INTERCEPTION OF SOVIET ICBM'S

General ABRAHAMSON. Here is a representation of one of those garages. It has those interceptors. Those interceptors can hit boosters. They can also hit a warhead or an ASAT that the Soviets send out.

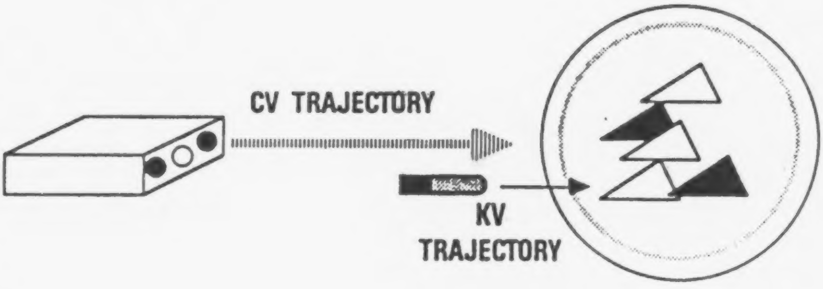
Now perhaps one of the most difficult ones would be if the Soviets use a nuclear warhead that they put off in space, and since they are intercepting outside some of their territory we have to at least think that.

So now you have to consider how big a kill zone would a nuclear warhead have. A nuclear explosion in space is not like what occurs on the surface of the earth. It is a radiation zone, and so this has to survive the radiation zone, and the right place for them to put it off was for this to go through it and have the radiation level high enough that it destroys the optics on those systems or the electronics inside or maybe even damage the outside of such a system.

Next, please.

ONE ON ONE ATTACK-2

SHOOTBACK FORCES MIRVs AND DECOYS



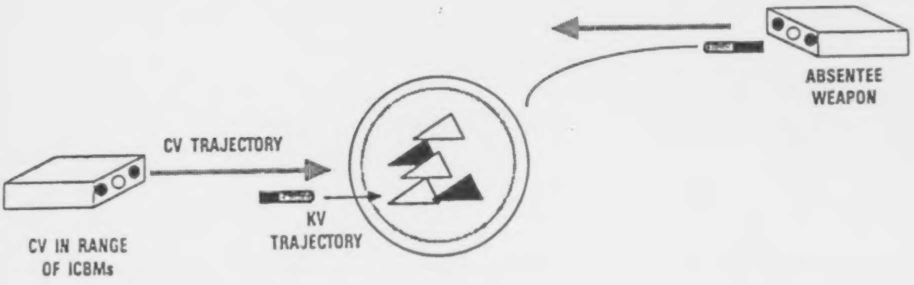
SOVIET USE OF DECOYS

General Abrahamson. However, we can shoot at those warheads, so one of the things the Soviets might do is to say let us put a decoy and at least put several up there in order to assure that that can go on. So they now have to—I am trying to show you the cost effectiveness balance, the ratio that again people simplistically deal with, and that is that they have to put several up there, and they will try to put decoys as well.

Next one.

ONE ON ONE ATTACK-3

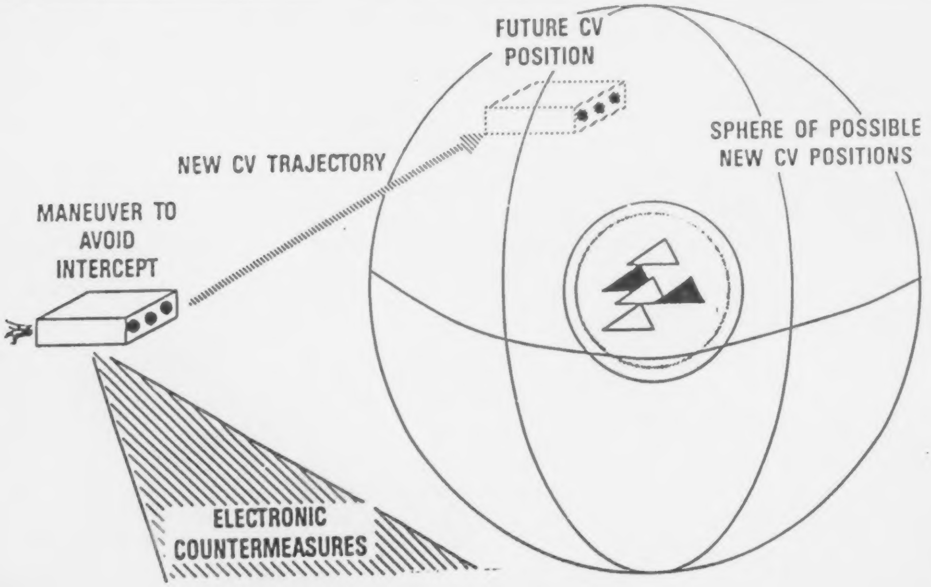
CROSS COVERAGE ALLOWS PREFERENTIAL DEFENSE


ABSENTEE
WEAPON
CV TRAJECTORY
KV
TRAJECTORY
CV IN RANGE
OF ICBMs

General ABRAHAMSON. However, they do not only have to deal with that one that is coming through. There is another one over here that can shoot back as well. This one might be out of the battle zone where it cannot reach the SSAT's coming up, but it could reach that. So they have to consider both of those.

Next.

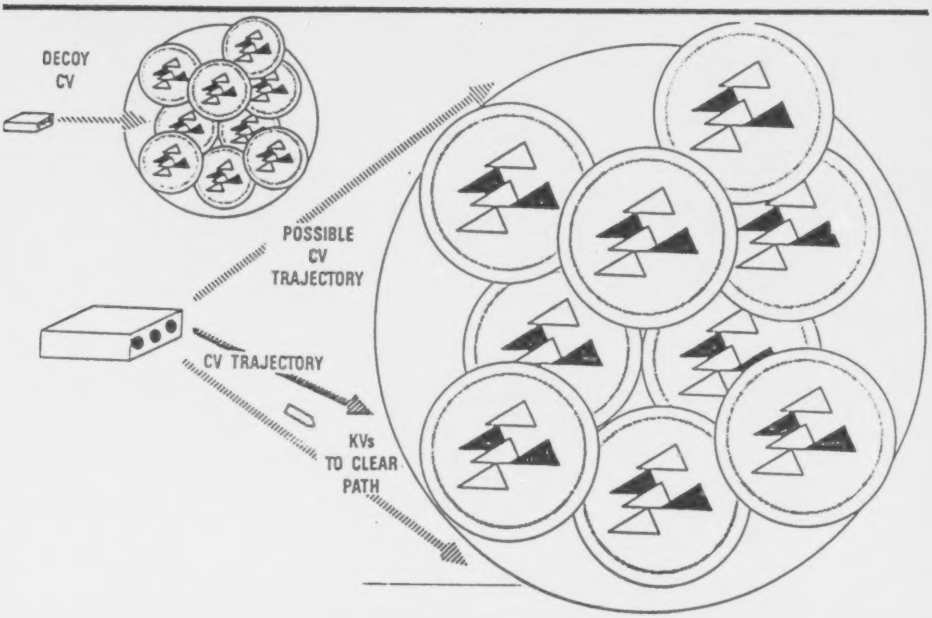
MANEUVER PLUS ECM TO AVOID INTERCEPT


FUTURE CV
POSITION
SPHERE OF POSSIBLE
NEW CV POSITIONS
NEW CV TRAJECTORY
MANEUVER TO
AVOID
INTERCEPT
ELECTRONIC
COUNTERMEASURES

General ABRAHAMSON. In fact, if this came in a little bit, the extent that it maneuvers and can maneuver outside of that kill zone, it is not just one area that they have to be able to fill up.

Next one.

MANEUVER AND DECOYS FURTHER RAISE PRICE TO THE ATTACKER

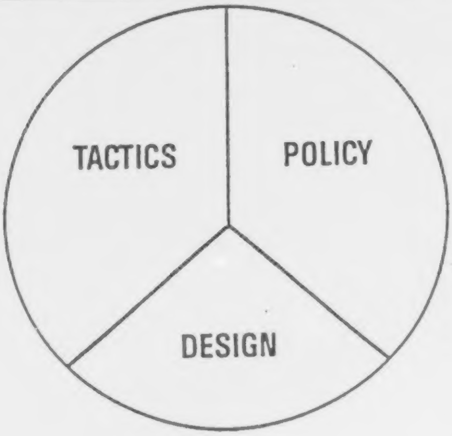


General ABRAHAMSON. They have to fill up a large volume of space. That takes a large number of ASAT's. If they are firing against the rail system, we talk about using decoys for the Soviet warheads. We can use decoys for our systems as well quite cheaply, quite inexpensively, and the cost effectiveness ratio, I hope you can see, is beginning to build up in favor of who can make the last move, and that is the defense people.

In a classified session I can show you real numbers where we are talking about hundreds of ASAT's that they would have to deploy in order to try to in an insignificant way begin to take down your defensive capability.

Now, let us just go on to another part of the program.

GENERAL PRINCIPLES OF SURVIVABILITY



- MANEUVER
- DISCRIMINATION
- SHOOT BACK
- EO/ECM
- DECOY DEPLOYMENT
- ANTI-SIMULATION

- ARMS CONTROL
- ATTACK DEFINITION
- ATTACK THRESHOLDS
- SELECTIVE DEFENSE
- EXTERNAL FORCES
- KEEP OUT ZONES
- VERIFICATION

- HARDENING
- SHIELDS
- DECOY DESIGN
- SAFETY MARGINS

LASER THREAT

General ABRAHAMSON. There are other elements of this, and I could get in a classified area to show you this, but ASAT's are not the only threats. The Soviets have an ongoing buildup in lasers. They are ahead of us in chemical lasers at this point. We have to consider that that may be a peacetime kind of threat. I have often said that we are building not only lasers to see how they can destroy missiles but we are also building laser armor to see how we could defend ourselves or to find out what the Soviets be able to do.

Here is a product of one of our laser armor studies, and the specific capability of this I cannot talk about, but this is a very effective laser armor for a satellite. The question is can that also be put on a missile, and we are answering those questions as well. It is more likely that they would put some of these kinds of systems on.

We are using our miracle laser out there against these. In fact, this is the penetration in a material that was intended to be quite laser resistant, and people were very hopeful that this was a pretty good laser armor, the kind of material that you can build a solid rocket type of missile out of. This is where we have hit it for only .014 of a second with that particular laser and found the penetration was quite deep.

The important point is out of this program we are finding that today's missiles are more susceptible to lasers than we thought. Some of the laser armor concepts are not as good as we thought, but we have bright people and I am sure they have bright people working on ways of dealing with this as well.

The answer is that we should always have at least two methods or more of being able to destroy these systems. If we relied exclusively on lasers, then the countermeasures for lasers are quite different from the countermeasures you would have to have for one of these kinds of systems.

Now, I have tried to build up the cost ratio between our system and theirs, and I will finish with just one or two points to show you that our research program is not merely technology. It is how do we deal with cost. In fact, I am spending time and effort trying dramatically to see that we can bring down the cost in production of these kinds of systems. This is just to show you that we are focusing on that so it will be affordable.

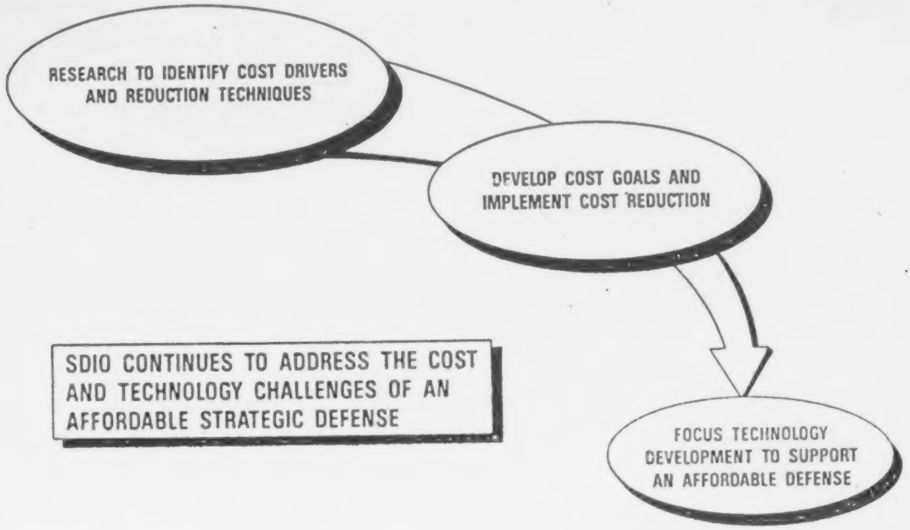
I stressed affordability last year not because we were throwing out the cost effectiveness at the margin criteria but because it has to be something that we can afford or I will not have brought forward a reasonable option for the Nation.

General ABRAHAMSON. We funded in this case the Army and the Air Force. We are systematically going through each of the projects and trying to find out what are the things that cost us a lot, why do they cost us a lot, and what should we do differently to ensure that we can create an affordable kind of option.

COST-EFFECTIVENESS

General ABRAHAMSON. We go out with the study teams, we go through management, we go through the manufacturing operations. We see how accounting is done, and we do not only deal with how much direct labor hours goes into this on the manufacturing line, but what is being done on the sidelines, because overheads are a very important part of these programs.

AN EMPHASIS ON COST



RESEARCH TO IDENTIFY COST DRIVERS AND REDUCTION TECHNIQUES

DEVELOP COST GOALS AND IMPLEMENT COST REDUCTION

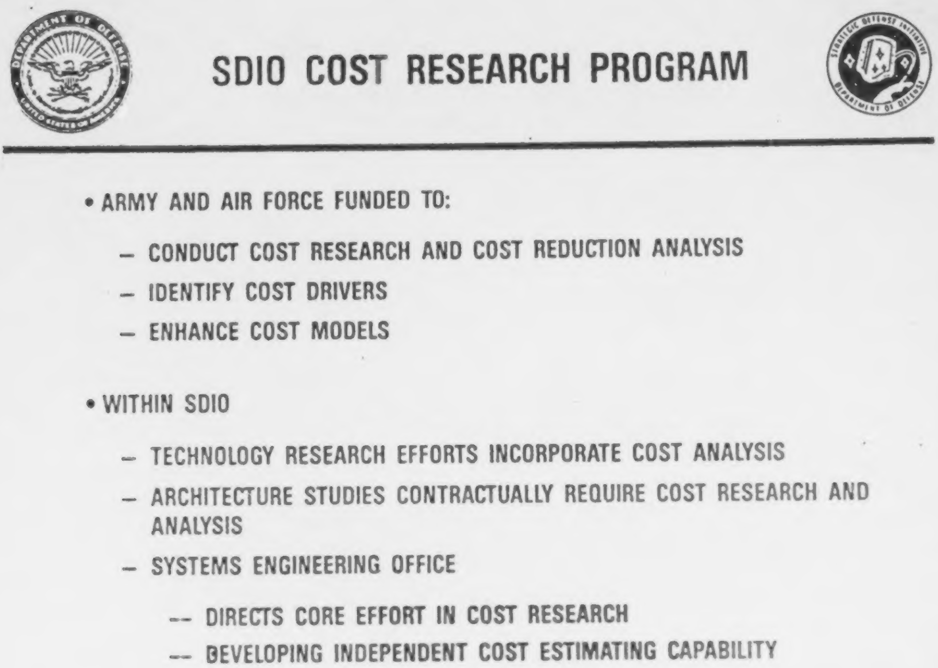
FOCUS TECHNOLOGY DEVELOPMENT TO SUPPORT AN AFFORDABLE DEFENSE

SDIO CONTINUES TO ADDRESS THE COST AND TECHNOLOGY CHALLENGES OF AN AFFORDABLE STRATEGIC DEFENSE

SPACE-BASED KINETIC KILL VEHICLE

General ABRAHAMSON. In the space-based kinetic kill vehicle, here is the cost in 1990's technology, and those are percentages that are piled up. And you can see—let me take one example. The focal plane, that is the eyes of this system. It turns out that that is going to be an expensive, expensive part of it.

And so our job is to ensure that we can bring that down. And we, with our studies, we try to identify how to bring them down.



SDIO COST RESEARCH PROGRAM

- ARMY AND AIR FORCE FUNDED TO:
  - CONDUCT COST RESEARCH AND COST REDUCTION ANALYSIS
  - IDENTIFY COST DRIVERS
  - ENHANCE COST MODELS
- WITHIN SDIO
  - TECHNOLOGY RESEARCH EFFORTS INCORPORATE COST ANALYSIS
  - ARCHITECTURE STUDIES CONTRACTUALLY REQUIRE COST RESEARCH AND ANALYSIS
  - SYSTEMS ENGINEERING OFFICE
    - DIRECTS CORE EFFORT IN COST RESEARCH
    - DEVELOPING INDEPENDENT COST ESTIMATING CAPABILITY

General ABRAHAMSON. For example, we have taken the focal planes, the cost of each of the elements, and we go digging all the way down to the module sizes, how the crystals are put together. And we try to identify, not business as it is done today, but how it should be or could be done.

And with enough money, and enough resources, we will be able to produce these things and have them ready so that the go-ahead means that we have production lines that can do this, not merely for SDI but for other programs as well.

Chairman STENNIS. Suspend a minute now, if you will.

General ABRAHAMSON. Yes. I will start with the last chart. Why do we not just put up our budget charts.

STRATEGIC DEFENSE INITIATIVE BUDGET REQUIREMENTS FOR FY1987–FY1989

($ IN MILLIONS)

PROGRAM ELEMENT	FY87 (CURRENT)	FY87 (SUPPLEMENTAL)	FY88 (BUDGET)	FY89 (BUDGET)
SURVEILLANCE, ACQUISITION, TRACKING & KILL ASSESSMENT	911.0	70.0	1,492.7	1,859.5
DIRECTED ENERGY WEAPONS	844.0	70.0	1,103.7	1,245.8
KINETIC ENERGY WEAPONS	730.0	60.0	1,074.7	1,199.7
SYSTEMS ANALYSIS & BATTLE MANAGEMENT	387.0	40.0	627.3	787.5
SURVIVABILITY LETHALITY AND KEY TECHNOLOGIES	338.0	260.0	900.4	1,162.2
MANAGEMENT HEADQUARTERS (SDI)	19.9		22.0	27.3
TOTAL	3,229.9	500.0	5,220.8	6,282.0

KINETIC ENERGY WEAPONS

General ABRAHAMSON. So what that means is this is one example of our program in the area of kinetic energy weapons. This summary chart—and I will leave this, sir, because I think this is what you have been asking me to provide—is how we have broken out our program in fiscal year 1987 amongst each of the major areas, how our supplemental breaks that out and how our 1988 and 1989 budget breaks that out.

And you will see that I have only been dealing with one slice of our program in kinetic energy weapons. But a similar kind of picture can be drawn in each of the areas across that entire program, and that would obviously exceed everybody's time.

Chairman STENNIS. All right. If you will hold that just a minute.

I want to suspend here now and give others a chance to shift to such questions as they may wish and subjects that they may wish to go into especially. And you can come back to this. You will be given every chance to come back to any part that you want later.

But let us try that out on this 8 or 10 minute rule. And I will turn to the Senator from Alaska, Senator Stevens, and I will then alternate.

Senator STEVENS. Thank you very much.

SDI SUPPLEMENTAL

That was a good presentation, General. Let me go to the supplemental. As I indicated in my opening comment, I think that is the most important thing we have before us today. As I understand, your supplemental includes $250 million for heavy-lift vehicle development, is that right?

General ABRAHAMSON. No, sir. The $250 million is for the general area of space transportation. Remember I talked about the cost investment and all of that. In all of our studies, we have been studying with NASA, with the Air Force, looking at other security programs the payoff for a low cost space transportation approach.

Senator STEVENS. Tell me, how much was associated—I have limited time. I need some answers, General.

General ABRAHAMSON. $114 million is what we are aiming at for the heavy-lift launch vehicle.

Senator STEVENS. Now, that heavy-lift vehicle is not just for your use, is it? I mean, if you developed it it would be shared with NASA, right?

General ABRAHAMSON. Absolutely, and the Air Force for other security programs.

Senator STEVENS. We have considerable backlog right now because of the lack of a heavy vehicle. Have you made arrangements with NASA so that you will go ahead with that, that that is your priority, an SDI priority, to develop that heavy-lift concept?

General ABRAHAMSON. Oh, yes. We are in discussions in how we can use NASA's expertise, how we can meet their requirements and make this a national initiative and not really an SDI initiative.

TITAN II

Senator STEVENS. Why can you not use a Titan II?

General ABRAHAMSON. The Titans and the shuttle both are effective systems for today. They are not large enough, but most importantly, they do not offer us the real cost reduction that I think that the Nation needs, not only for this program but for others.

Senator STEVENS. In other words, if you had at least part of this $500 million, you would use it to apply this cost reduction program to the problem of heavy-lift into space, is that right?

General ABRAHAMSON. Yes, sir.

Senator STEVENS. You have worked out an arrangement with NASA so that SDI would take the lead in that, right?

General ABRAHAMSON. Yes, sir. Actually, the agent would be the Air Force, and the Air Force is working out that relationship with NASA.

NARROW VERSUS BROAD OPTION

Senator STEVENS. Now, I am worried about another thing now, and that is this so-called—and Senator Hollings mentioned it. Where do we come to the point when the issue over the narrow versus broad option impedes upon your research program?

And let me be specific. Does it impede in any way on the supplemental or on the 1988 budget? Will the expenditure of the funds you have requested either for 1987 or 1988 be impeded in any way by a decision on narrow versus broad?

General ABRAHAMSON. We have assembled the program now with, in accordance with the President's direction, within the restrictive interpretation of the treaty. In fact, just yesterday we announced the winners of a satellite program called the BSTS. This is the surveillance system not only for a near term capability or the first-term technologies, but for the longer term as well. My aide is struggling for a picture of that satellite.

But we announced two who are in competition. The first challenge that they will have is to build an experimental satellite that shows us confidently that we can see much better than the ones we presently have, that they will have the capability to do this kind of a job.

They will not be able to launch that satellite until somewhere in the 1991, 1992, if it slips the way things have happened in the past maybe even 1993, timeframe. However, based on this contract award, they will be starting to work on a satellite that is limited in capability to ensure that we not put something in space that is capable of substituting for an ABM radar.

So we do not give it full capability. Now, what does that mean? That means that we are going to put up a satellite that is limited in capability, that will have no residual capability. And they are starting to work on it now even though it will not be deployed—and by "deployed," I mean put up for an experimental operation—until 1992 or so.

Senator STEVENS. But you could compartmentalize that contract so it could be expanded if we do, in fact, have to use the broad interpretation later, could you not?

General ABRAHAMSON. Surely.

Senator STEVENS. And you can expend these moneys within the narrow interpretation at this time within 1987 and 1988?

General ABRAHAMSON. I can do that. What it will mean is that we will make an extra satellite launch, an extra satellite that will be very expensive, perhaps cost the Nation an extra $1 billion.

Senator STEVENS. I am of the opinion that the actions that need to drive the question of whether or not we go broad or narrow is not the appropriations process or the authorization process. So if we can keep an understanding that the moneys that we are looking at now are to be expended within the narrow interpretation, without regard to what happens in the future, then I think we have a different issue here.

Is it possible for us to assure the Congress that the 1987–88 money will be spent in accordance with the President's current decision of the narrow interpretation?

General ABRAHAMSON. That is the way the budgets were put together and that is the way our plan is presently laid out. The answer is yes, sir.

Senator STEVENS. OK. Now, one last question, Mr. Chairman, and I have tried to be brief.

The concept of a decision being made on a treaty interpretation obviously impacts your program.

General ABRAHAMSON. Yes, sir.

Senator STEVENS. And there obviously is a timeframe here now where you have got to look at Ambassador Kampelman and say: Max, you have to get me an answer within that timeframe if we are going to be able to proceed and be able to protect the security interests of our Nation if we do not get an agreement that specifies what we mean in terms of broad, narrow, and the whole spectrum of arms control that I think is over there in Geneva.

Now, is there a time at which we have to have a decision on broad versus narrow, so that your program is not jeopardized as far as security interests of the country is concerned?

General ABRAHAMSON. There is not a time in the near future where you fall off of a cliff and where, if the decision is not made, you cannot recover by spending more money.

Senator STEVENS. Define "near future" for me. Are you talking about the next Presidential term, 1988 to 1992, or between now and 1990?

General ABRAHAMSON. I think we are talking in the next year or perhaps a little longer than that. But remember that——

Senator STEVENS. Within the balance of this Presidential term, can you live with the narrow interpretation?

General ABRAHAMSON. Yes, sir. I have said that in the past, and I think we can.

Senator STEVENS. Thank you.

Chairman STENNIS. Thank you, Senator. You used only 8 minutes, by the way. You get a very high score.

That brings us to you, Senator Johnston.

Senator JOHNSTON. Thank you, Mr. Chairman.

General Abrahamson, this is very interesting——

Chairman STENNIS. Excuse me just a minute. I believe Senator Hollings had come in first.

Senator HOLLINGS. Thank you, Mr. Chairman. I will follow up on what Senator Stevens was trying to get at, but I think you did not complete the answer.

It would be under the narrow interpretation, since you are letting that contract and it only has, as you say, a partially capable satellite, that thereafter, having done it as a partially capable satellite and not having the residual capability, it would cost you another billion bucks later on and probably 2 years' delay, is that not right?

General ABRAHAMSON. That is correct, sir. What it means is that that satellite is an experimental satellite that is used only for experiments and will not be as complete as one that would not be required to have the data processing and those elements removed.

POSITION OF SDI PROGRAM WITHOUT SUPPLEMENTAL

Senator HOLLINGS. And since it will not have data processing, it is only a limited kind of testing. And as a result, of course, it starts extending the time and the cost, and the more time and cost, as we see already with the space station in the morning news—that has jumped from $8 billion to $21 billion in about 2 years' time.

So you are dealing with things that the Appropriations Committee is vitally interested in, and we are not interested in slippage. Everyone likes—I can tell my distinguished colleague, these are damage control questions to try to get what we can get.

And perhaps we will have to play that game, but I would rather be a little bit more forthright about this and really make the decisions so the scientific acumen and knowledge and talent would all join together, knowing they have got the full support, and not like a Contra program, whether it is going to get a little bit and denied and rescinded and a little bit more, and you get a warning even after you win it and everything else of that kind.

We should not bog down a program of defense in that way.

What happens, General Abrahamson? What happens if you do not get your supplemental?

General ABRAHAMSON. I believe there are two things in terms of the program. We will not be able to carry out the plans that we laid a year ago. The Congress denied that by imposing very, very large cuts in the program. It will slow several of the projects, particularly the one that will have the largest cost return for the whole Nation, not only SDI, and that is the development of space transportation, first the heavy-lift launch vehicle, but the whole space transportation infrastructure.

It will delay that dramatically and, by doing that, it will raise the cost of an eventual SDI deployment. But it will also raise the cost of the space station, and the Nation will not be able to take advantage of these for other systems as well.

HEAVY-LIFT LAUNCH VEHICLE TECHNOLOGY COSTS

Senator HOLLINGS. And in terms of costs and delay, can you give us some general parameters of the time and money involved?

General ABRAHAMSON. Well, that is I think——

Senator HOLLINGS. You do not have to quantify. We are going to be on the floor, and there is a bad thrust in this Congress to have no supplemental. That is the best way to kill SDI, just do not have any supplemental at all.

And I think it is vital that we get that heavy-lift vehicle up there, and we need the Air Force to go.

And incidentally, Mr. Chairman, we had hearings in our other authorization committee for NASA, and NASA is having a difficult time playing catch-up ball to get the shuttle back up, much less take the job of the space station itself. However, the R&D factor is at the civilian level in NASA, and I think we have had Secretary Aldridge and NASA come up and testify to that extent.

So that is why I am asking. Now, what are we talking about in cost and what are we talking about in time? You have got to be a little bit more direct. That is what is going to impress our colleagues, not me being for or against it.

General ABRAHAMSON. I would like to give you a very specific answer for the record, sir. However, obviously if we cannot start in a robust way something like this major investment in heavy-lift launch vehicle technology, the cost is at least a year, perhaps 2 years.

Now, what that means is that can be translated quite directly into increased cost of deployment. So therefore, if the Nation in fact started a deployment out in that timeframe, you can calculate that quite directly. And I think that it is in many millions of dollars.

Senator HOLLINGS. Thank you, Mr. Chairman.

Chairman STENNIS. Yes; thank you, Senator.

Gentlemen, that brings us now to Senator Garn.

Senator GARN. Thank you, Mr. Chairman. I will be brief because I wish primarily to follow up on what Senator Stevens said.

COMPLEMENTARY EXPENDABLE LAUNCH VEHICLE

Often in this debate over SDI, that becomes so emotional on one side or the other, without benefit of the facts, or really many of my colleagues in both the House and the Senate not really understanding what the system is all about—I wish they could have all seen your presentation today.

But normally, we overlook some of the important parts that have benefits far beyond SDI, and that is the heavy-lift vehicle Senator Stevens has referred to. Two years ago, during the debate we were having prior to the Challenger accident, we had a rather vigorous debate in this committee and also in the HUD-Independent Agencies Subcommittee over a CELV or the complementary expendable launch vehicle.

And at that time, I and others suggested that this was an important goal totally apart from the SDI debate, that we move ahead with the heavy-lift launch vehicle that had the capability of putting into low earth orbit up to 250,000 pounds; and that I felt that the most cost-effective way to proceed with that was a shuttle-derived vehicle.

And that got confusing, people thought that we were talking about an SRB and shuttles, and we were not. We should use that R&D capability to expand beyond the shuttle for this heavy capability, rather than going with something completely new or refurbishing Titans or other existing vehicles.

At the time the answer that I got: "There was no validated requirement for that type of heavy-lift vehicle." I disagreed at the time. Two years later, we are talking about the need for a heavy-lift launch vehicle, I wish we had been listened to a couple of years ago.

And so we have come a long way, I guess I could say, in a couple of years. But there is an important need for this country, beyond its need for SDI, for its implications with the space station, and in other areas of civilian and Air Force launch requirements over the next few years.

So you have a request as part of this supplemental, but I am glad it has been brought up by others as well, for shuttle-derived heavy-lift launch capability. How soon would you estimate its initial availability if we did approve this supplemental?

General Abrahamson. That is an area that we are working with NASA and the Air Force on now in coming up with the proper acquisition strategy. And I think it relates to your earlier comment about shuttle-derived technology and how one goes forward.

We believe that the right objective is to have one that will be equally weighted in this way: That we go first of all for low cost, but equally important that we have high reliability and operational flexibility. That means getting it in a short preparation period to launch it and be able to get it off easily and put lots of different kinds of loads on there, but have confidence that it will work when you launch it.

Now, sometimes those kind of objectives and an early operational capability, they are tugging at two different ends of the problem. We think that if we have now many, many designs—NASA and the Air Force and SDI have been working on this for a year and a half.

We have contractors out there, and we have a very large report on various architecture systems. We have really been undertaking this very seriously.

How do you get those two components of reliability and flexibility, as well as low cost, into such a system? Now, we think that the way you do that is you set that objective, you start out on a design that will achieve that. However, if you need an earlier capability, you may only have to develop the first part of that design, to that first step, that first step of operational capability.

And let me give you an example. Low cost might eventually mean that you would have flyback boosters for such a thing that is going to cost a lot of money and take a lot of time. You can get a large amount of the cost savings by temporarily using strap-on solids, so long as the fundamental structure was designed in such a way that eventually you could get the low-cost flyback boosters that go with it.

And so what that means is we are trying to structure a concept so that the amount that we have to invest in the research and in the development phase is at least phased to the benefits and the needs of the Nation, so that we do not start out on just the most expensive possible program, even though those needs are not as clearly defined as one would like.

We think that that is a sensible program.

COORDINATED NATIONAL SPACE POLICY NEEDED

Senator Garn. Let me interrupt you there. And I do not disagree with what you have said. But my concern—and I want to make the point very strongly today is that we need a coordinated national space policy, not just for SDI, the future of the space station, Mars probe, going back to the Moon, but for whatever we do.

I feel that there is not a national space policy. Because of budget constraints, we are having too many arguments between SDI, the Air Force, and NASA. It is not dissimilar to what I am talking about here. Two years ago there was no validated need when I was talking about a heavy-lift launch vehicle. Now everybody agrees there is a need and we have lost, not totally but partially, that 2 years in development.

And it is not dissimilar to the problem after the *Challenger* accident. The inability of the Air Force and NASA and other agencies in coming up with even a decision of whether we needed a replacement orbiter.

Essentially, Senator Stevens and I had to drive that decision, because the administration could not come up with a decision. Weeks and months went by, and now we find the fourth orbiter under attack.

The nature of my questions is simply to make a point: We do need a heavy-lift capability. If the supplemental request is denied there would be serious implications for SDI, and our overall space program purely civilian needs. I would like to try and separate the supplemental request from an emotional debate over SDI and whether we should deploy it or not.

I would make the point that there are some rather important aspects of this particular supplemental that mean a great deal to this Nation's space program, military and civilian. We should not ignore those and get it all wrapped in those who just want to oppose SDI for whatever reason.

Thank you, Mr. Chairman.

Chairman STENNIS. Thank you very much.

That brings us, according to my listing here, to Senator Johnston.

Senator JOHNSTON. Thank you, Mr. Chairman.

KINETIC-KILL VEHICLES

General Abrahamson, your presentation was very interesting and it confirms what I have been reading and understanding, and that is an increasing emphasis on kinetic-kill vehicles. Certainly if we are going to go to an early deployment, it would have to be through kinetic-kill vehicles.

And I am therefore very concerned about why it is that we would be returning to kinetic-kill vehicles after they had been rejected after the Bambi study in the 1960's and after the High Frontier study in the early 1980's. And particularly, I am advised that kinetic-kill vehicles—that is, a rocket hitting a rocket—would not arrive there in time if the Soviets went to fast-burn boosters.

I am further advised that fast-burn boosters are today's technology. They know how to do it, we know how to do it. And I am further advised that, for example, as Harold Brown wrote in that article in Foreign Affairs some time ago and as most of the scientific community that I know anything about has said, that the cost advantage would be with those who build fast-burn boosters to defeat the kinetic-kill vehicles.

As George Miller from Lawrence Livermore Lab says: There would be a catastrophic failure against a fast-burn booster.

Now, tell me first, can you get there in time if the Soviets go to fast-burn boosters? And secondly, is that today's technology? And third, why do you disagree with Harold Brown, who says that the economic advantage is with the Soviets in building fast-burn boosters, as opposed to us building KKV technology?

Senator GARN. General, before you answer, could I just ask unanimous consent that some additional questions I have for the General be responded to in writing?

Chairman STENNIS. Yes, without objection that is agreed to.

FAST-BURN BOOSTERS

General ABRAHAMSON. The fast-burn booster, I think, falls in the category of one of these things that we must consider, we must consider very carefully. But it has been improperly and not very fully examined in the past.

Senator JOHNSTON. Excuse me? Not very fully what?

General ABRAHAMSON. Not very fully examined in the past. The Soviets have spent nearly a trillion dollars, if we were to count it in our own economy, in our economic terms—which, by the way, are not directly applicable to them—in terms of building up their present inventory of systems. Their present inventory is not fast-burn boosters.

And the key element here is, what is a fast-ourn booster, how fast? And I can show you what are a simple Soviet response that certainly accelerates and goes to a faster burn booster than they presently have. However, I will have to provide that in a classified regime, and I will do that.

Senator JOHNSTON. Well, fast-burn boosters are today's technology, are they not?

General ABRAHAMSON. Yes, sir, they are. In fact, we build, for instance, things like that as well.

What is normally commented on in terms of a fast-burn booster is something that would be so quick that you would burn out early in the atmosphere or accelerate through the atmosphere and then quite quickly, and the timetable that people talk about are between 60 and 70 seconds.

We have designs for those things. We do that. We do not just——

Senator JOHNSTON. The MX is 150 seconds, is it not?

General ABRAHAMSON. I am not sure of the classification of the actual number, sir.

Actually, the Soviets have several systems that are much faster than their present SS–18's. There is no question about that.

We believe that, in fact, you can be effective through the fast or through the boost phase, and that whatever system you might put up would not be wasted, because it would then be employed in the post-boost phase. And we are doing some very classified studies on exactly what that means as well.

The answer simply is: Yes, they could build fast-burn boosters; it would cost them a substantial portion of their trillion dollar investment in order to do it. The size and shape of a fast-burn booster is very different from what they presently have.

It is a major question whether or not they would fit in their present silos and whether or not it would cause them to have to then put a whole new construction project out for their silos, et cetera; and that if they did not do that, if they went on the mobile trains, then that costs them, training, and it costs them a whole new infrastructure. That is a major investment on their part.

I am not——

Senator JOHNSTON. Excuse me. Let me interrupt just to get the simple answer. The fast burn booster is today's technology?

General ABRAHAMSON. It is possible to build, but not without a substantial investment on their part.

DEFEAT OF KKV IN BOOST PHASE

Senator JOHNSTON. Secondly, it would catastrophically defeat a KKV vehicle in the boost phase?

General ABRAHAMSON. Depending upon how fast, it would. And by the way, it is easier and cheaper for us to double the speed of that than it is for them to double the speed of a very large booster.

So the first generation of such a system here would probably then be only usable against their existing systems.

Senator JOHNSTON. Well, your own national labs used the term "catastrophically defeat." You used 70 seconds just for reaction time in your chart up there, and you tell me it is not going to catastrophically defeat it.

General ABRAHAMSON. No, I do not think so at all. I think that it will, in fact, have a significant effect on the first generation of these kinds of systems. But it is precisely because of that that we have a program to deal with, in fact, the fast-burn boosters through laser systems and other kinds of systems.

But it is wrong to say, to invent in the mind a system which could be built, but which would cost a great deal of money, and use that as an excuse to not prevent or not move forward on the kinds of technologies that can be used against today's threat or even tomorrow's threat.

Senator JOHNSTON. Yes, but you see, General, our DOD twice considered KKV vehicles, in the Bambi program and again in the High Frontier program, and they rejected that, did they not?

General ABRAHAMSON. Yes.

COST OF FAST-BURN BOOSTER TO SOVIET BUDGET

Senator JOHNSTON. They rejected it because of the very reasons I am telling you. Harold Brown is not a newcomer to this business. He says the cost advantage is on putting these fast-burn boosters on rockets.

And, General, you are not going to make us believe that is going to cost them a trillion dollars to put—to invent a rocket with a fast-burn booster with today's technology.

General ABRAHAMSON. I did not say that. I said it would cost them a substantial amount, a substantial fraction of what they have cost today in order to put their existing system out, in order to replace a majority of that with fast-burn boosters.

Senator JOHNSTON. Well, it may cost them a substantial fraction of what it cost us to deploy a kinetic-kill vehicle. But I can tell you, at least your scientists tell me and tell our people, your scientists, not the Union of Concerned Scientists, say that the advantage is clearly with they who build the fast-burn booster, today's technology, to defeat this KKV system.

General ABRAHAMSON. I have some wonderful people that are working on this program. They are working on their system and they believe in their system, and they are convinced that they have the answer. And that is exactly the kind of team that I want to produce this program.

Now, unfortunately, they are all frustrated. They are frustrated because we do not have enough money to carry out all phases of the program, and, therefore, indeed they do get enthusiastic about theirs. And unfortunately, some of them think that the way to get more money for theirs is to repeat to some of your people that the right way is to depreciate some of the other systems.

Now, I would rather have teams of people made up of people who believe in what they are doing and are enthusiastic about that and accept some of the difficulty on answering your question than teams that are not convinced that their job is the right way.

Senator JOHNSTON. I think these are serious scientists at Livermore. I do not think they are trying to downgrade your system because they want to build beam ones.

Senator STEVENS. That is all they do represent, though, Senator.

Chairman STENNIS. Senator Rudman, that brings us to you, sir. Ten minutes.

Senator RUDMAN. Thank you, Mr. Chairman. I am not going to take it all.

CURRENT TECHNOLOGY VERSUS FAST-BURN TECHNOLOGY

I just want to follow up, because I read all of the same data and had some of the briefings. And I guess you are both saying something that is accurate, but I do not think the issue is joined.

It is my understanding that, if you were to take the Livermore results, it would be matching current technology against fast-burn technology. And I do not want to get into an argument whether it is current or not. Is that not so, it is an apples and oranges argument?

General ABRAHAMSON. I think the answer is yes. And I think, sir, that the point that I was trying to make with Senator Johnston is that the difference between moving from where they are now to where they are—or where they could go, is a very substantial investment.

Senator RUDMAN. Well, there is no reason to assume that, if fast-burn technology can be perfected for boost vehicles, that it cannot be perfected for intercept vehicles; is that not so?

General **Abrahamson**. That is exactly the point that I was making.

Senator **Rudman**. And if the velocity increases were identical, then I assume that the timeframes would be nearly the same as they are under current match, is that correct?

General **Abrahamson**. That is correct.

Senator **Rudman**. And the last question I have on that: Is it not also so that, if in fact the Soviets adopt fast-burn technology, they give you a much easier targeting problem? Is that not true?

General **Abrahamson**. Not only do they do that, they probably have to offload some of their warheads. So in fact, we win in the sense that already, even without firing a shot, they are beginning to unload warheads and they do not maintain the same ratio of warheads to vehicles.

DETECTION SYSTEM RESEARCH

Senator **Rudman**. Well, General, as you know, where I come from up in the Northeast, up in New Hampshire and northern Massachusetts, some of the premier research in detection is going on.

It is my understanding, without getting into classified areas, that, if the Soviets went to fast-burn vehicles you could take an awful lot of money out of the kind of sophistication you currently are having to put into your detector systems, without getting classified, your microprocessors that handle that, because the number of bits of information you have to process would be, without getting into the numbers, way down. Is that not correct?

General **Abrahamson**. Thank you, sir. Maybe you should come on this side of the table. [Laughter.]

Senator **Rudman**. I just think we ought to get the issue out. I have a high respect for my friend from Louisiana, but I just do not agree with that at all and I think he is wrong. But that is why we are all here.

General **Abrahamson**. I think the important point that you are bringing out is that it is a much more complex issue than the simple assertion that fast-burn boosters will defeat one of these kinds of technologies.

And it is exactly why we are carrying a program that has alternate approaches, and all of those alternate approaches have to have growth paths. And it is my job and my responsibility to show that as we go through these growth paths that, in fact, the cost advantage will remain on our side.

The growth paths will not only be exclusively with these kinds of systems. That is obviously the case. The growth paths have to be the kind that present the Soviets with several different fundamental phenomena. And those different fundamental phenomena, the combination, is what causes them then to be in a difficult position.

MX MISSILE SURVIVABILITY

Senator **Rudman**. I have one question really of my own, that is not a follow-on. One of the things that I have had a hard time understanding in terms of the prioritization of what you have been doing down there is, assuming we are going to have—assuming the current ABM treaty in its current status, just make that assumption with me for a bit, I am concerned with all of the survivability questions that relate to MX in particular; that we have not spent more money or applied 1987 technology to what was decided in 1975 as an insoluble problem.

Why are we not looking more at what is allowed under a point defense, to make a field of MX missiles very survivable by a system that in fact, taking today's technology, might work and might ensure a high degree of survivability? It seems to me that the ultimate safety that you get from SDI is the synergism between survival and first-strike capability, because, obviously, if you protect it well enough, then that is a terrific threat that may remain, submarines aside. And I am talking about the land-based leg of the triad, the missile base.

Why are you not doing more in that area? It seems to me you can do it. The technology, as I have got the briefings, is rather—well, it has progressed centuries since 1975. And we are having this fight about survivability. We are allowed to do it under the ABM treaty. We are allowed, I think I am correct, 100 launchers or 100 intercepts or 100 missiles in one system.

Why do we not do it and say to the Congress: Look, we are getting results here; we are making this field of missiles survivable; we are making first strike against that field very counterproductive for them, because something is going to survive and that is a big missile with lots of warheads with a lot of accuracy.

Why are we not doing that, General? That is one of my problems?

General Abrahamson. I think that the answer is that, first of all, the treaty limit for that kind of a system is 100 interceptors. And certainly you could—by putting 100 interceptors out there, it certainly would have advantages of the kind that you talked about.

But by merely going to 200 interceptors, that would be—or 200 warheads, which is 20 SS–18's, they would have stamped out that kind of capability.

Our first phase of such a system, whether it is early or late, would have layers that operate in the boost phase, but also in the late midcourse. And we do have an option for adding some of those terminal kinds of systems. But we think that terminal systems by themselves do not have the tremendous advantage of having layered defense.

And what layered defense means is that it is not merely a matter of putting 20 more SS–18's targeted on the problem, but it is a matter of putting hundreds more.

Senator Rudman. I do not disagree with that at all, General.

Mr. Chairman, I hope we have a closed session at some point this year with the General, because there are so many things we cannot talk about. But I would just say that, although under your hypothetical you are correct, there is information that we all share that would indicate that you might not be able to defeat them all, but there are ways of multiplying the effects of what you use in a way that you would still have enough survival, and I guess that is my point.

I have been very frustrated at seeing the enormous technological advances we have made and during the battle—and it is a reasonable battle—on the survivability question of MX's which we have been wrestling with around here. And we have got this enormous investment in MX. The incremental cost of 50 more would be very low compared to what we have spent.

Maybe we ought to do it if we can prove it is survivable. And if there were a way to do it with current technology, that would be something that we would want to look at. And that is something that I just do not think you paid enough attention to, and not you personally but the policymakers who decide that.

Thank you, Mr. Chairman.

Chairman STENNIS. Thank you, Senator, very much.

Senator Leahy, that brings us to you, sir.

REQUEST FOR SUBMITTED QUESTIONS BY SENATOR BYRD

Senator LEAHY. Thank you, Mr. Chairman. Mr. Chairman, I would ask unanimous consent—I have some questions from Senator Byrd—that they might be submitted to be answered for the record.

Chairman STENNIS. Without objection, the questions from the Senator from West Virginia will be put in the record.

REQUEST FOR SUBMITTED QUESTIONS BY SENATOR DECONCINI

Senator LEAHY. And also some from the Senator from Arizona, Senator DeConcini.

Chairman STENNIS. They will be included in the record for answering.

Senator LEAHY. Thank you, Mr. Chairman.

HEAVY-LIFT LAUNCH VEHICLE SUPPLEMENTAL

General Abrahamson, I am one of those who is old-fashioned enough to think that an urgent supplemental is supposed to be an urgent supplemental and not just an extra appropriations bill.

You say there is an urgent need for $114 million for heavy-lift launch vehicles. Last year, there was no such urgent need. Nothing was asked for a heavy-lift vehicle, and, in fact, last year I think the program manager for the whole space transportation budget for SDI only asked for $36 million.

What has changed in 12 months that something that was not even asked for last year has suddenly become so urgent, that we need a quarter of a billion dollars in supplemental and almost a half a billion dollars beyond that? Has the world situation changed in 12 months?

General ABRAHAMSON. The world situation has changed. If you would care to do that, and obviously again that has to be in classified session. But right now, the Soviets have on the pad today a large heavy-lift launch vehicle.

Senator LEAHY. They had one a year ago, too. But money for a U.S. heavy-lift vehicle was not necessary then.

General ABRAHAMSON. But the projections of how soon and when they might be able to utilize such a thing are very important and have to be in our total equation.

I would say that the really critical issue is that we have completed a year and a half of study and effort over time, and as we begin to look at—and perhaps we had not done enough deployment planning in the beginning. But as we begin to look at the single most important cost factor, the single most important savings factor for the entire system, it clearly is low cost space transportation.

And we felt that it was vital——

URGENCY OF SUPPLEMENTAL

Senator LEAHY. I do not think you have answered my question, General. My question is why is it suddenly urgent? I mean, we have seen the heavy-lift vehicle of the Soviets for a long, long time. Certainly everything we know about it today we knew a year ago when your own program manager did not think there was any need for it.

In your statement you say we need the heavy-lift vehicle to meet future mission requirements in the Department of Defense, NASA, and our civilian space endeavors. But they say they have no pressing need for a heavy-lift launch vehicle, and that all of their lift requirements could be met without it.

Isn't it true that this is really needed only for SDI?

General ABRAHAMSON. No, I do not think it is only needed for SDI. I think SDI provides the majority of the requirement if the Nation is to have any deployment opportunities out in the mid-1990's. And that is quite clear for us, that is important.

But then when you add on top of that the kinds of potential savings that these might offer if NASA knew and were aware that they could rely, that such a vehicle would be ready for them, and that the Air Force had the same kind of a certainty for their planning. That is larger than SDI.

Senator LEAHY. But there is nothing new that we have learned from last year? That is the point I meant. You are talking about a quarter of a billion dollars in an urgent supplemental, with no new facts than we had last year, when it was not even requested in the regular appropriations.

General ABRAHAMSON. Well, maybe the only real answer to that is that we did not have enough money last year or perhaps enough foresight to have properly emphasized that.

INTENSIVE R&D EFFORT IN NEW TECHNOLOGIES BY SOVIETS

Senator LEAHY. You say in your statement that the Soviets have the most intensive research and development effort in the application of new technologies to ballistic missile defense in the world today. Are the Joint Chiefs aware of that?

General ABRAHAMSON. Yes, sir.

Senator LEAHY. Well, in their fiscal year 1988 posture statement the Joint Chiefs say that, of the 20 most important basic technology areas—which presumably are the most important for SDI—the United States leads in 16, we are tied with the Soviets in only four, and in no area, according to the Chiefs, does the Soviet Union lead the United States.

Are you overstating the problem, or are the Joint Chiefs understating it?

General ABRAHAMSON. No, I do not think so. I think that the way in which that was stated was in the context of fundamental technology. I think you have to look at the overall programs that the Soviets have, and when you add their operational ABM system, the way they are upgrading that ABM system and utilizing the potential that that gives you, and then add to it the technologies in lasers and many of those areas, then I think that the equivalence of the statements becomes closer.

Senator LEAHY. But the Joint Chiefs' statement does precisely that. They still say we are ahead in 16 technologies and tied in only four. I understand you are a strong advocate for SDI, but it looks to me like you are gilding the lily here.

I mean, I do not see any interpretation other than to say that your statement is at odds with the Joint Chiefs.

General ABRAHAMSON. Well, so that I do not try to interpret what they are saying, I would like to get an answer for you there for the record, sir. I do not believe that I am gilding the lily.

SOVIET STRATEGIC DEFENSE SYSTEM

Senator LEAHY. You also say that the Soviet strategic defenses are extensive and growing. I am aware of their strategic defense system around Moscow of 100 missile interceptors. Are they adding to those missile interceptors?

General ABRAHAMSON. I think that you should not measure the effectiveness or the time limits or the problem by the number of interceptors that they have.

Senator LEAHY. Are there more interceptors beyond those 100 around Moscow?

General ABRAHAMSON. No. What I indicated, sir, is I do not think that you measure it by the number of interceptors. I think you measure it from a military point of view by the capability that they presently have.

They are expending hundreds——

Senator LEAHY. Are they expanding beyond Moscow? I understand that they may be improving the capability. I just want to make sure that I have not missed something. Have they gone other places than Moscow?

General ABRAHAMSON. Not that we know about. But that is not the significant issue.

The significant issue is the command and control capability and the warning capability associated with their entire new set of radars, and those are dramatically being expanded.

Senator LEAHY. Is that what you mean by saying Soviet strategic defenses are extensive and growing? That is the command and control, and not the interceptors themselves?

General ABRAHAMSON. That is the long pole in the tent in our system, and I think it has the same significance for them, sir.

Senator LEAHY. Isn't the system around Moscow basically the technology that we gave up a decade ago?

General ABRAHAMSON. Those are entire new missiles that are going into place there. They do represent older technology. When you combine that with their efforts and the possibilities at least in some of the more exotic technologies, I think you will see that their program is not one that is fundamentally limited either by the 100 interceptors—but it offers the potential to do something very real, and perhaps do it more quickly than we could.

Senator LEAHY. Thank you.

REQUEST FOR SUBMITTED QUESTIONS BY SENATOR LEAHY

I have a number of other questions for the record, Mr. Chairman.

Chairman STENNIS. All right. Without objection, the Senator's questions will be inserted in the record for personal attention of the General, and you will answer them.

ABM TREATY INTERPRETATION

All right, that brings us to Senator McClure.

Senator McCLURE. Thank you, Mr. Chairman.

Thank you, General Abrahamson, for your testimony this morning. I know this is not the time and the place for us to debate the narrow versus broad interpretation of the ABM treaty. I appreciate what Senator Hollings said earlier on that subject today and what he has said elsewhere in a different forum, and there will be more said about that later.

I cannot help but make this comment, however, and that is that some of the people who argue for the narrow interpretation of the ABM treaty have been reading the wrong part of the history. They may have analyzed historical records correctly, but they are the wrong books. Like a student assigned a subject to write a treatise on Shakespeare who comes in with a marvelous piece on Milton, but it has very little relevance.

And I think that that is exactly what has happened on some of this interpretation of the ABM treaty. People have read the wrong record and come to the wrong conclusions.

But if I recall correctly, General, in response to a question that Senator Stevens had asked, you were asking if it were possible for you to live within the narrow interpretation of the ABM treaty for a period of years, and you gave a detailed answer about your development process and that, yes, you could for the next 4 years, I think, through the 1990–91 timeframe, live within the ABM treaty's narrow interpretation, but ultimately if you did that and then we went to a broad interpretation you would have to redo some of what you had done earlier, and it could cost us a billion dollars more.

General ABRAHAMSON. Well, it is not merely a billion dollars more, actually. We are in the process of trying to quantify that properly so that the President will have available better programmatic information to make this policy decision.

However, that billion dollars is a rough estimate, but it is a rough estimate on only one program.

HEAVY-LIFT PROGRAM

Senator McCLURE. That is in heavy-lift?

General ABRAHAMSON. No, on the surveillance satellite program.

Senator McCLURE. Does it have cost implications in the heavy-lift program?

General ABRAHAMSON. Well, the heavy-lift we could go forward with. We could go forward with that if—what I answered there was, if it were delayed it would have cost implications for the deployment of the program of billions of dollars.

Senator McCLURE. So we can do it, but there is—it is not just a technological limitation; it also has implications with respect to ultimate cost?

General ABRAHAMSON. Yes, sir.

REQUEST FOR SUBMITTED QUESTIONS BY SENATOR MCCLURE

Senator McCLURE. Mr. Chairman, I have a number of questions which I would like to submit for the record for response in writing.

Chairman STENNIS. All right. Without objection, Senator, your questions will be placed in the record for the personal attention and answering by the witness.

Senator McCLURE. I have no further questions.

Chairman STENNIS. Very good.

Senator D'Amato.

Senator D'AMATO. Thank you, Mr. Chairman.

Mr. Chairman, I would like to submit a statement in its entirety for the record, with your permission.

Chairman STENNIS. Without objection, your statement will be put into the record for the purposes of examination and response by the witness.

[The prepared statement of Senator D'Amato follows:]

PREPARED STATEMENT OF HON. ALFONSE D'AMATO

U.S. SENATOR FROM NEW YORK

Mr. Chairman, I thank General Abrahamson for coming to testify before this committee and I look forward to his testimony.

In an austere fiscal year, the Strategic Defense Initiative has received special budget consideration. The administration has requested an increase from $3.2 billion for this fiscal year to $5.2 billion in fiscal year 1988 and $6.2 billion in fiscal year 1989. I would be surprised if the administration were able to reach fiscal year 1987 request level of $4.8 billion for the next fiscal year as well as receive the $500 million supplemental request for this fiscal year.

This observation is not based on any opposition to the program. Indeed, I have been a supporter of the Strategic Defense Initiative since the President went before the Nation 4 years ago to introduce this new research program. I do, however, expect that SDI will be facing the same budget considerations as every other program in this year's budget request. Fortunately, SDI will be one of the few programs to be increased.

SDI continues to be an intensive research program focused on advanced defensive technologies with the goal of the eventual elimination of the threat posed by nuclear missiles, and with the aim of lessening the probability of nuclear war. By devaluing Soviet first strike weapons—the land-based, highly accurate ICBM's—then deterrence can be preserved.

Our national security depends upon our ability to stay technologically ahead of the U.S.S.R. Although the United States cannot produce weaponry on the massive scale as the Soviet Union, we do continue to have a technological edge. SDI is intended to exploit this advantage.

It is not only maintaining and using our technological advantage that makes SDI research important. The Soviet Union is very active in this area of research. The Soviet Union has the world's only operational antisatellite capability, as well as the only operational antiballistic missile system. The U.S.S.R. is actively developing and modernizing its defenses, including air defense and surface-to-air missiles. The Soviet Union now has a clear advantage in strategic defense that offers Moscow an increasing ability—and perhaps, the temptation—to deal with the retaliatory forces of our Nation and our allies.

The SDI program is a prudent response to a very active Soviet research and development program. While the United States ponders interpretations of the ABM treaty, the Soviet Union clearly is violating it. The President recently issued a report citing Soviet noncompliance with arms control agreements. According to the report, the installation of Krasnoyarsk radar is an outright violation. In addition, the Soviets' concurrent operation of air defense and ABM components and their development of modern air defense systems that may have ABM capabilities, are probable violations. Even despite this present threat, the issue of proceeding to deployment of an actual ballistic missile defense system will not arise for several years, and only after the necessary preliminary research has determined that such systems are both feasible and cost-effective.

Our Nation needs the Strategic Defense Initiative. Research must continue as planned.

The likely indirect, nonmilitary benefits of SDI should be remembered as well. Our space research in the early 1960's led not only to a lunar landing, but also to hundreds of new technological developments. I expect SDI research will lead to new technological discoveries which will greatly enhance our industrial productivity and improve our standard of living.

I commend the fine work you have done thus far, General Abrahamson, on the President's Strategic Defense Initiative. Such a program with a large price tag and high visibility needs a tireless and dedicated advocate like yourself. I look forward to working with you on this important initiative.

Thank you, Mr. Chairman.

Senator D'AMATO. Thank you, Mr. Chairman.

I would also like to say that I found this probably one of the most enlightening presentations, General Abrahamson, and I commend you for it. I think we need a little bit more communication with Congress and the general public. Those charts, that were not classified, really answered, I think, questions that many of the people in the public and members of the Congress have, and I found it very illuminating.

Chairman STENNIS. That is why we are having this hearing now, Senator. That is a very good suggestion.

SOVIET DEPLOYMENT OF SDI

Senator D'AMATO. General, various articles have been written about what the Soviets are doing in relation to SDI, numerous articles. The Wall Street Journal on December 16 printed an article entitled "Moscow's Biggest Star Wars Drive," in which they indicate that the Soviets since 1976 have been outspending the United States in this initiative by some 15 to one to speed up the development of their strategic defense system.

I would like to know if you have been able to verify or if you have information that confirms that analysis, that 15 to 1? And what are we talking about in terms of dollars, if you have that?

General ABRAHAMSON. Sir, first of all, those are always very difficult numbers, and I think that I need to provide that properly answered by the people who have that responsibility for the record.

SOVIET CHEMICAL LASER DEVELOPMENT

I think that it is quite clear that they have had a major program in certain areas that has been outspending us for a very, very long time. Let me give you one example of it, chemical lasers. They have a large number of very large ground-based lasers that are part of their research program, and we can know a little bit in that area. We can get some indication of how they are progressing.

Some of those ground-based lasers were in place and operating in the late 1970's. Some of them are coming on now, later, and will have—I am not sure we know all of the implications for some of those systems until we begin to see them operate.

Senator D'AMATO. General, on that point, are they in your opinion able to conduct this kind of work within the confines of the ABM treaty?

General ABRAHAMSON. I think we have no way of being able to verify all of the tests that they do with some of these technologies. A laser test is something that we do not have the technical means of knowing whenever they do a laser test what they are doing or how they are doing it.

We have some things that we can begin to make some judgments about, but we cannot—I think that that is an impossible verification problem.

By the way, that is why I think that the framers and the negotiators of the ABM treaty struggled for the research question and finally in fact rejected the idea that they could control research under the treaty.

Senator D'AMATO. Very illuminating. Thank you, General.

Thank you, Mr. Chairman.

Chairman STENNIS. Senator Johnston, we come back to you now.

Senator JOHNSTON. Thank you.

BAMBI AND HIGH FRONTIER PROGRAMS

General Abrahamson, about 9 weeks ago I made a request for the DOD and State Department studies on Bambi and on High Frontier, and I understand those requests were routed through you. Can you tell us when we might receive those?

General ABRAHAMSON. I have it today. I can only apologize to you, sir, that it took us a little longer than it should have.

I would like to characterize the answer just briefly. The evaluations that were made of the High Frontier study—and that is the important one—essentially said that the cost estimates were optimistic, that they could not be accomplished with today's technology—and remember, that was 1982—and that there was insufficient analysis of some of the operational implications of such a system.

My answer to you really outlines the fact that, while that analysis at that point in time may indeed have been appropriate, that we have moved the technology forward in a dramatic way, that we are proceeding with the system——

EARLIEST DEPLOYMENT OF KKV SYSTEM

Senator JOHNSTON. Well, I can read that. But let me ask you this, if I may, General. When would the earliest deployment you can see with this KKV system be made?

General ABRAHAMSON. First of all, it depends upon many factors. It depends, obviously, on how much investment that we can make as a nation in this.

Senator JOHNSTON. Well, I know all of those variables. But given reasonable success in all of the areas, what is the earliest you could see?

General ABRAHAMSON. What I have indicated is that if there were a very early decision to go ahead, that somewhere in the 1994–95 kind of timeframe would be possible. With a Manhattan Project, it could come a little earlier.

Senator JOHNSTON. Now, General, how many individual rockets would be necessary, first to deal with the present threat, 300 second burn time of SS–18? And how many would be—well, first of all, answer that question, to get the 90 percent plus Reagan goal?

General ABRAHAMSON. We have not done that particular kind of analysis. We did not set a 90-percent threshold. I think what I tried to indicate in the earlier part of my discussion is that what we would be looking at in that phase one is a level that has military significance.

Senator JOHNSTON. You cannot tell me approximately how many it would take?

General ABRAHAMSON. For 90 percent, I have not done that particular analysis.

Senator JOHNSTON. How many would it take for—this interfere with timing, what percent is that?

General ABRAHAMSON. We have put it—we have made a straw man kind of presentation to the Joint Chiefs so that they can then begin to examine that and see how it really does.

Senator JOHNSTON. What percent effectiveness does that assume?

General ABRAHAMSON. Some of that now is classified, but let me talk about the architecture, since that is, I think, the direct number.

Senator JOHNSTON. Well, let us say how many would it take?

General ABRAHAMSON. We were talking about numbers on the order of magnitude of 300 or so of the satellites that would be in orbit. Now, remember this is for a thin system, and that is on the order of 3,000 of these missiles.

Senator JOHNSTON. 3,000 missiles?

General ABRAHAMSON. Now, that is a straw man and it may be, with military judgment applied by the operational community, might change. But the point was this was at least considered as a point of departure and one that would provide enough understanding of the dynamics for them to think through.

EFFECTIVENESS IN DESTROYING SOVIET MISSILE FLEET

Senator JOHNSTON. In interfere with timing, we are talking about in a range of 10-percent effectiveness roughly?

General ABRAHAMSON. I am sorry? Ten-percent effectiveness against their total fleet?

Senator JOHNSTON. To take out 10 percent of their offensive ICBM's?

General ABRAHAMSON. No, we are talking about higher levels, but it is a more complex kind of decision structure, and that is something that the JCS is looking at right now. We are not measuring it in percentage of what their total fleet could be, because that is a function of where that fleet is, does it include submarines coming from one place or just the concentrated heavies.

Senator JOHNSTON. How many missiles?

General ABRAHAMSON. The studies have been based on differing sets of criteria, and that would be how they would use those kinds of systems. The results are classified and I would like to come back.

More important, I would like to qualify it to say that this is——

Senator JOHNSTON. Well, let me—if you do not know the answer——

General ABRAHAMSON. I do know the answer, but I cannot comment on it.

Senator JOHNSTON. Well, the answer is classified. That is all I need to know.

SYSTEM ARCHITECTURE

Do you have an architecture?

General ABRAHAMSON. Yes, sir.

Senator JOHNSTON. And is that available to be seen?

General ABRAHAMSON. Yes, sir.

Senator JOHNSTON. I would like to see it. We have not been able to. Have you done any cost parameters at all?

General ABRAHAMSON. We have used some of today's costs, estimating relationships which—and notice that cost program that I laid out, in order to try to bound and put some cycle on the total thing—and I think that the important thing is that the cost, if that were validated, the size of the straw man system that we put out, we are talking about investments on the order of $40 to $60 billion, and not out of line with some of the present weapons systems that have been proposed.

Senator JOHNSTON. $40 to $60 billion, and that is for 3,000 orbiting rockets?

General ABRAHAMSON. But that is not just for those. It is for the entire architecture. That does not represent—and I guess this is the important thing. It does not represent a specific plan. That plan has to be validated.

The important thing is that the cost estimating is based upon such a system, using today's estimating relationships, which I do not believe are entirely valid, but not considering all costs or perhaps all risk areas, which might balance some of those. It is not a number that is so far out of, away from existing kinds of costs.

COST ESTIMATING RELATIONSHIPS

Senator JOHNSTON. Can we get those cost data furnished to us?

General ABRAHAMSON. Yes, sir, we can provide you the information about the cost estimating relationships.

Senator JOHNSTON. Is that classified?

General ABRAHAMSON. When we get to all of the specific deployment numbers, it is, yes, sir. The total overall number—remember, I am giving you a range—is not an unreasonable number.

Senator JOHNSTON. Of course, the architecture would be classified?

General ABRAHAMSON. Yes, sir.

Senator JOHNSTON. Well, I would like to get both the classified and the unclassified description of the costs, because that really deals with us. I mean, if we are talking about 1994 I am sure these numbers are not going to get it for SDI.

General ABRAHAMSON. Sir, I think the most important point that I would like to make is that what is being examined now is a phased deployment. It is not a commitment to deploy in 1994. What that says is if a national decision were made and made in a timely way, that is the inner edge of the envelope when you could begin to do some of those particular kinds of deployments.

It does not assume that there is under active consideration at this point at any level a policy decision to deploy in that phase, and that is what I started with. I said that phased deployment is quite different than an early or a late deployment. That is a second policy decision.

PROJECTED COST ESTIMATES

Senator JOHNSTON. Let me ask you on these costs, you can give us projected costs as opposed to cost goals or cost relationships?

General ABRAHAMSON. Because we are using today's cost estimating relationships, which by the way do not always apply for some of these technologies. And so what it represents in my judgment is a poor attempt to begin to get at what the real things are, but better than none at all.

[The information follows:]

COST ANALYSIS ACTIVITIES

The SDI Program cost analysis activities to date focus on (1) improving and extending cost-estimating models and data bases to meet the cost estimating challenge; (2) developing credible cost estimates for use in architecture evaluation and to assist in decision making and program planning; (3) pursuing cost reduction through innovative management techniques in the execution of the research program; (4) developing cost-efficient new technologies as part of the technology research program; and (5) developing goals through cost-reduction research.

IMPROVING COST ESTIMATING CAPABILITIES

As noted above, SDIO is engaged in developing and improving cost estimating tools to allow cost analysts to produce more definitive cost estimates. For example, current optical seeker cost models are based on data from seekers weighing around 40 pounds, about 1,400 cubic inches in volume, and using scanned bilinear focal plane arrays. Some of SDI's proposed seekers are likely to weigh 2 pounds, be only about 300 cubic inches in volume, and use staring mosaic focal plane arrays, with considerably smaller gimbals and torquers. While this represents a formidable technology development and manufacturing challenge, the work to meet these challenges is well under way. Volume production requirements will offer opportunities for automated manufacturing processes for many SDI systems and components and will provide economies of scale and learning-curve effects not possible in current, one-at-a-time or batch production processes. Current cost models do not produce credible cost estimates that incorporate these advances. As a result, the SDIO has initiated studies to update data bases and to extend current cost models. The Strategic Defense Initiative Organization is being supported by the U.S. Army Strategic Defense Command and the U.S. Air Force Space Division in this necessary cost research and cost model development. This cooperative effort is designed to meet the cost challenges we all face in the strategic defense arena.

At present, the U.S. Army Strategic Defense Command [USASDC] is developing models and cost estimating relationships for advanced technologies that apply to USASDC activities, including directed energy weapons; kinetic energy weapons; surveillance, acquisition, tracking and kill assessment [SATKA] systems; BM/C3; and free electron lasers. The U.S. Air Force Space Division is engaged in a similar set of activities for SDI-related space-based systems. Specific areas of Space Division research include the development of cost models for launch, space operations and support, space power, large space structures, sensors, and software. These tools will be used to develop more precise estimates as results become available.

SDI EXPERIMENTS

Senator JOHNSTON. General, you said in the SDI report in 1985 and again in 1986, it said that the projected experiments can be done within the present restrictive interpretation of the treaty. As I understand your testimony here today, you said that what you plan to do during the balance of this administration can be done within the restrictive interpretation of the treaty. Is that correct?

General ABRAHAMSON. Let me make sure that I really put that in proper perspective, sir. My direction is to ensure that the program is conducted within the restrictive interpretation of the treaty until there is a policy decision to do otherwise. That decision must obviously consider more than merely the technical program, but has to consider all of the other implications of it, which are not my responsibility.

But nonetheless, once one considers all of those things, then that decision would allow us, if it were made, to conduct a program that would get to the level of confidence to make a national decision, we believe, more quickly and more efficiently.

Senator JOHNSTON. Mr. Chairman, could I just follow up with a question or two?

Chairman STENNIS. Certainly.

DEPLOY OR CHOOSE TECHNOLOGY DECISIONS

Senator JOHNSTON. When would this set of decisions be made as to whether to deploy or choose a technology? When would those be made? And if made in the way that you would like them to be made, would then during this administration you have to do something inconsistent with the narrow interpretation of the treaty?

General ABRAHAMSON. Those decisions could be made any time in the process.

What it means is, it allows you to go more directly to a higher confidence point so that a national decision could be made.

Senator JOHNSTON. If that is done——

General ABRAHAMSON. There isn't some physical point where all of a sudden you stop and that's it; you can't do anything unless you go outside of the treaty.

There is a natural point where it doesn't make sense to stay in the treaty any longer. So under any other circumstances, not considering policy issues which are important and must be part of such a national decision, that if you are looking at a program that had those kind of limits in it, you wouldn't find it.

Senator JOHNSTON. All right. Let me give you the context of my question.

Some are concerned more than others about the treaty and breaking the treaty without having, as you say, higher confidence in this, suppose there were language in the appropriation bill that said none of the funds in this act or any other act may be used to conduct any experiment, making a deployment, or do any other thing, inconsistent with the narrow interpretation of the treaty?

First of all, if that were a 1-year limitation, would that conceivably impinge on anything you want to do?

General ABRAHAMSON. We'd have to go through and do this program by program. But it would impact in this kind of a way. There are planning activities that have to be done, if you're going to examine the advantages or disadvantages of being able to conduct tests more freely than what we presently have.

There is hardware that has to be built, as I indicated in my testimony in Senator Hollings——

Senator JOHNSTON. Would any of these things break the treaty?

General ABRAHAMSON. No, none of these things would break the treaty. Your language, if it were written in such a way that I couldn't proceed to build the hardware, then it would have an impact on the program.

Senator JOHNSTON. Well, if I may just ask the final question. Because I want to be sure, because someone may put in this amendment, and your answer is important.

The language of the amendment would not impinge on any test you want to make, any deployment you might want to make, or—in fact, it would not impinge on anything you want to do, that language, would it?

General ABRAHAMSON. I'm sorry, what language?

Senator JOHNSTON. Language that says, none of the funds in this act or any other act may be used to make any tests, deploy any system, or otherwise break the narrow interpretation of the treaty?

General ABRAHAMSON. I would have to go back and examine that very carefully. Frankly, I think the issue that the legal people would have to look at is, if we were planning or building hardware which someday might be used in a test, that would be an important question that would have to be answered.

Senator JOHNSTON. Well, could you give that to me in writing, the answer?

General ABRAHAMSON. Yes, sir.

Chairman STENNIS. Senator Kasten, that brings us to you. And may I announce that when we do recess today, it will be until next week on Tuesday morning at 9:30 in this room.

Senator Kasten.

Senator KASTEN. Mr. Chairman, thank you.

SPACE TRANSPORTATION FUNDING

General, thank you for your testimony. I regret that I wasn't able to be here for all of it, but I appreciate your testimony and I look forward to working with you.

I want to just talk about the funding or the actual appropriation of this whole account with particular concern about the space transportation section of it.

I understand that Senator Garn spoke about the space transportation section of it, and I think that he and a number of us understand that we need a heavy-lift capability, or a heavy-lift capacity, in many aspects of our space program, not just the SDI.

It concerns me, then, how the allocation is being made in terms of how much so-called SDI money is, in fact, heavy-lift capacity money which would be used for the SDI but which would be necessary even if we weren't going forward with SDI that would be used in other areas.

So my first question to you is, why is this a specific part of the SDI. Particularly in the 1987 supplemental, space transportation is listed as a specific line item at $250 million. Why is that a specific item here, and why has it been allocated to SDI in this particular amount?

General ABRAHAMSON. First of all, there are many things in my program that fall in that category. Fundamental research that we are doing is serving many, many users. But the philosophy has been, when we put these five program elements under centralized management, that without centralized management, you would not be able to ensure that element A of technology would arrive at the right point at the right time, so that it can join up with element B and element C.

And therefore, the ideal way to conduct any program is to ensure that the technologies that are absolutely critical are coming forward at the right time.

Now, I can give you examples where some of that has not worked as well as we would like. And it's difficult, whenever you have two or three agencies each putting a part of a budget into a total line item.

SP–100 PROGRAM

And I can give you an example: the SP–100. That is a program to develop a nuclear reactor for power for space. We need that increased power. NASA can use that increased power.

And it's been a long term area of both interest and capability in the Department of Energy.

It is funded, unfortunately, three ways: in the NASA budget; in the Department of Energy budget; and in my budget.

And all of us have to meet and work constantly to try to ensure that it maintains the right priority when each of those budgets has conflicting demands.

Obviously, NASA has demands now for science and space transportation that says, we can't fund as much as we would like for this long-term application.

I have problems when my budget is cut by 36 percent.

And the Department of Energy has conflicting priorities.

So whenever you put programs that rely on a plan, and that plan must be carried out in several different budgets, subject to different priorities, you have different problems.

NSC STUDY

Now, we have studied this, however, very carefully on a national basis. As I indicated, there is a study that is at the National Security Council now which represents a careful examination of not only the possibility of heavy-lift launch vehicles, but also the potential requirements of all of the agencies.

COORDINATION OF AGENCY INVESTMENT IN TECHNOLOGY

And so we've tried to approach this in a national way. Up until this point in time, all of the agencies concerned have been investing in technology. To some, that applies more; to some, it applies less.

NASA has had some money in advanced technology for advanced space transportation systems.

So have we. Not a great deal, not as much as we needed. But so have we, and so has the Air Force.

We've been trying to coordinate those budgets. What we finally came to the conclusion was, that the Nation needs this. And there's only one way that the Nation can get it, and that is, if we bite the bullet and say, let's increase the funding sufficiently so that we will indeed lay out a program that makes sense.

And by the way, this is not a new start. This is a technology investment for a little bit further, and then there will be a specific design that will be selected, and at that point in time, the budget location may change.

But we had the opportunity in that we had an approved fiscal 1987 supplemental that was being considered, and I made the painful decision of going back and kicking out other things in my budget that were important in order to put this in at the right priority level. And that's what we had it.

Senator KASTEN. Well, that's exactly the thrust of my question, that this could—you're sitting here with an Air Force uniform on—this could be in the Air Force budget, which is probably not under the same kind of pressure that the SDI budget is under now.

General ABRAHAMSON. Well, you're making an assumption about that, and you have to ask the Air Force about that, sir.

Senator KASTEN. It could be under other areas. Now, are you telling me that you're going to fund the low-cost space transportation and the so-called heavy-lift capability, solely out of these dollars until we decide where the program is going to go?

Or that the dollars for low-cost space transportation and heavy-lift capability are now distributed, but you ended up with $250 million? It's the latter, right?

General ABRAHAMSON. It's the latter. We put it in that budget. I committed that I would give it the same kind of priority in reallocating some of the fiscal 1988 funds. Obviously, that will depend on how much of our fiscal 1988 funds are there.

Because the other agencies didn't have much latitude. However, the Air Force has put a wedge in the out-years. And I don't know what the NASA wedge might be in the out-years as they begin to look for 1989 and beyond.

So those decisions are still to come. The important part is—and perhaps it's even more important than the finish date, and when it is—is that if the Nation needs it, you've got to start.

And the rule ought to be, if you're going to start, you'd better start. And that's what we're going to try to do.

REQUEST FOR SUBMITTED QUESTIONS OF SENATORS KASTEN, HOLLINGS, AND PROXMIRE

Senator KASTEN. I've got additional questions I'd like to submit for you on the record. And particularly, looking at this same question going out into 1988 and also the out-years and on some other subjects.

Thank you, Mr. Chairman.

Chairman STENNIS. All right, Senator, your questions will be in the record without objection, questions and the responses of the witness.

Senator JOHNSTON. Mr. Chairman, I have questions for the record from Senator Hollings, from Senator Proxmire.

Chairman STENNIS. The Chair hears no objection to including those questions in the record also for the attention of the witness.

Chairman STENNIS. Senator Cochran, that brings us to you, sir.

Senator COCHRAN. Thank you, Mr. Chairman.

ABM TREATY INTERPRETATION

I want to congratulate you, General Abrahamson, for the outstanding work you and your organization have been doing in the 4 years that you've been involved in the Strategic Defense Initiative.

In light of the pressures that are on the budget, and the reductions that have been made in the funding, I think remarkable progress has been made.

I'm concerned very seriously about the discussion that's going on about whether we ought to have a narrow or a broad interpretation of the ABM treaty.

What worries me is the statement that you make on page 1 of your testimony this morning, in describing Soviet strategic defenses.

In part, you say, the Soviet Union has an anti-ballistic missile system established. And the only anti-satellite system. An extensive research and development effort in the application of new technologies to ballistic missiles defense; the most intensive in the world today.

My question is: Is that consistent with a narrow interpretation of the ABM Treaty by the Soviets?

General ABRAHAMSON. I'm not sure that there's any way that any of us can answer that, sir. I think we do know one important thing, however, and that's that in establishing that system, they are building a radar at Krasnoyarsk which is a clear, and straightforward violation not just of an interpretation of the treaty, but the fundamental precepts of the treaty.

And that violation had to be in planning, and has been implemented, long before SDI, otherwise, they wouldn't be at the state of maturity they are in the construction of that particular radar.

U.S./SOVIET INTERPRETATIONS OF ABM TREATY

Senator COCHRAN. Well, I think it clearly indicates an intention. And the actions that we have observed on the part of the Soviets have indicated what their interpretation of the ABM Treaty is, and it's certainly not a narrow interpretation.

Your statement goes further on the next page and says that one of the reasons why we are embarking on the Strategic Defense Initiative is to provide a hedge against the potential for Soviet efforts to exploit emerging ballistic missiles defense technologies, and a possible breakout from the ABM Treaty.

What concerns me is that while we're engaged in a very visible and sophisticated discussion—some may say debate; I really haven't heard the other side of the debate yet—about whether we are locked into, or should adhere to a very narrow or strict interpretation of the ABM Treaty, the Soviets are continuing to develop and test new technologies, if I understand your statements this morning.

And I just wonder, how far behind we're going to end up being in the effort to understand the technologies, their application, their possible use to protect the security of our country, if we continue to cut back on the request for funding, and continue to throw up this smokescreen of interpretation of the treaty as an excuse for voting against funding of the program.

That's what really worries me. What's your reaction on that?

General ABRAHAMSON. Well, obviously, my job is to do the best job I can within the funding and also within the limits on the program.

But I think it does illustrate a profound difference between our societies. We are a nation of law, and we are a nation that respects law, and does our very best to live within the intent of various treaties.

And I think that's probably I'm sure some of the generation here. But as we think about the kinds of agreements that really offer us improved security with the Soviet Union, we have to understand that their best means of verification is our open society, and our free press, and our own respect for law and the way we try to deal with it.

And we have no equivalent of that working in our favor in the Soviet Union.

Senator COCHRAN. Thank you very much, Mr. Chairman.

Chairman STENNIS. Thank you, Senator. Thank you very much.

General, you've rendered a real service here today in my opinion. I know you've been helpful to all of us who are on this committee.

And I'm proud that the American people have a chance to hear the testimony directly on this important subject.

I haven't any leanings in it, not yet; I mean definite decisions. But I have an interest in it.

Senator Johnston, let me call on you now if you have any further questions.

I've announced already that we'll have another meeting of this committee next Tuesday beginning at 9:30 a.m. in this room.

PROTECTION OF U.S. SATELLITES OVER SOVIET AIRSPACE

Senator JOHNSTON. I just have one question here.

General, you said earlier that you would know if they sought to shoot down your satellites, because that would be a hostile act; you could launch your airplanes, et cetera.

Now suppose the Soviet Union said, orbiting SDI satellites over the Soviet Union is a hostile act. If you do it, we're going to shoot them down.

How would you protect them?

General ABRAHAMSON. We have to be able to—we are spending time in the planning. I would give you the wrong impression if I said we know all the answers to that yet.

But we are trying to think through how one begins a deployment process that would allow you to successfully deploy even in the face of hostile actions.

And there are methods and ways to approach that, for example, putting them all at higher altitudes until you have sufficient so that they can protect themselves, with a number of decoys.

Senator JOHNSTON. What kind of higher altitudes?

General ABRAHAMSON. At substantially higher altitude that those operating altitudes that you would like eventually.

Senator JOHNSTON. Well, you can't use——

General ABRAHAMSON. And then you bring them down when you have a sufficient formation that they can protect themselves.

Senator JOHNSTON. Well, you can't use a kinetic kill at a higher altitude, can you?

General ABRAHAMSON. The point was, how do you successfully deploy in the face of a determined effort during peacetime, which clearly would be a major crisis, to deal with it.

I'm not saying that in the beginning you would use that and you would have immediate capability against their systems.

But if you got sufficient up at higher altitude, then you could quite quickly move to lower altitude and have it in an operating mode. But you put them at higher altitude where they can survive——

Senator JOHNSTON. Well, at higher altitude they can't work, can they? Kinetic kill can't shoot down a——

General ABRAHAMSON. That's correct. But the intent is to put enough of them there until they can be mutually self supporting and then bring them down.

That may not be the only way. I'm sure there are other kinds of things that we could talk about in classified sessions.

But the important part is, number one, we are thinking that through. I don't have all the answers, but we aren't ignoring the question.

Senator JOHNSTON. But your only answer now is to say you would put them out of range?

General ABRAHAMSON. I'm saying that one of the schemes would be to start at higher altitude, and when you have sufficient that they are mutually self-supporting, then you bring them down.

Then they are down to an operating altitude where they can be used. At that altitude, then they become operational for their primary mission, the primary mission of being able to provide defense in the boost and the post-boost phase.

SATTELITE MANEUVERABILITY

Senator JOHNSTON. Bringing them down takes a lot of fuel, doesn't it?

General ABRAHAMSON. All of the satellites would have to be maneuverable.

Senator JOHNSTON. General, as I read this very quickly, it envisions—the high frontier envisioned, as I got it, some 7,776 orbiting rockets. Are my numbers correct on that? 432 platforms, is that right?

General ABRAHAMSON. I didn't read that that carefully, since that's an old study, so that I can confirm the actual numbers.

Senator JOHNSTON. And the judgment on that conclusion was that that was grossly inadequate because of the absentee time over the target.

Certainly the absentee time over the target, that's just a physical fact. And if that conclusion was valid at that time, that 7,776 orbiting rockets was insufficient, that conclusion would also be valid now, wouldn't it?

General ABRAHAMSON. No, sir. It's certainly a factor. It's a significant factor, and it's one that we have to consider. But when we try to put in place a full defense someday, when a decision to go ahead would be, it wouldn't rely exclusively or totally on boost defense.

That would be only one element of such a defense. And certainly other systems that are part of it would not suffer the same absentee ratio. So that——

Senator JOHNSTON. What other systems?

General ABRAHAMSON. Such as ground-based systems or submarine systems or the directed energy systems. They also have absentee ratios, but different than the ones from these.

Senator JOHNSTON. Now, beam weapons are how far away?

General ABRAHAMSON. It depends on how strong they're going to be made. Sir, you know, what you're doing is, you're trying to set up a specific kind of architecture, and that architecture—and then use it to punch holes in what we're doing.

And that's all well and good, and there are lots of potential holes. The problem is, what I'm trying to do is develop our technology so we can put it in several different kinds of architecture, not make the fundamental commitment to this number or that number, and it will be very, very powerful.

And when you take the time, and I hope your people will take the real intent to study how this technology——

DEVELOPMENT OF HARDWARE IN OPPOSITION TO TREATY

Senator JOHNSTON. General, I can assure you we have taken a great deal of time. We have talked to your scientists. Many, many of them—you see, one of my concerns, if what you say is correct, that is, that what you want to do is develop the technology, develop the R&D, then there's no problem.

I am for a robust R&D program.

But what you just said to my earlier question, as I got it, is the thing that may break the treaty, that you're concerned about, and you have to go back to talk to your lawyers, is, you want to develop the hardware, right now, during this administration, maybe, which in turn would break the treaty.

Now, that's the fundamental question. Isn't it? Isn't that what you said?

General ABRAHAMSON. I said that we have to develop the experimental hardware. And the question is, how is that experimental hardware to be used, and is it used in an experiment that would in fact be allowed under the legally correct interpretation of the treaty or a narrow interpretation of the treaty.

Now, that's not my responsibility to make that particular judgment. But it is my responsibility to see that we have a program that can go forward as fast as possible.

Senator JOHNSTON. Well, we want to go forward as fast as possible, General. But that treaty, in the minds of some of us, is that which keeps us from a gigantic space race.

The High Frontier said, the $100 billion cost estimate, at the time they made the estimate at that time, they said that one of the problems there was that that was grossly too small.

I'm sure that an analysis today would say that your $40 to $60 billion is grossly too small, even though that's for this preliminary estimate, what do you call it, interfering with timing.

That's not the whole system. That's just some undescribed interfering with timing that takes out a very small percentage of the ICBM's.

Nevertheless, in order to break the treaty, we think we ought to have—at least I think we ought to have—something more definite, something more dependable, something with a greater assurance of its effectiveness, than I've heard today.

I mean, every time we try to go after a specific program, you say, well, you're focusing on a specific program. Of course I am. We're spending specific dollars. We're breaking a specific treaty. And that's why I want to know what your architecture is.

General ABRAHAMSON. Sir, we're not breaking any treaty.

Senator JOHNSTON. Well, then why not let me put on that language I described? You say you've got to go back to your lawyers. You've got to go back——

General ABRAHAMSON. You asked me if that would in fact have an implication for the speed at which we could go forward.

And what I had to say was that I need to assure myself, in order to answer that question accurately, whether or not the hardware I build because—not that we're going at the time that we're building the hardware break the treaty—but if it were to be used in something that were under the broader or the narrower interpretation of the treaty, would that prohibit us from working on that hardware.

And that's the answer that I gave you; not that we're going to break the treaty.

VALUE OF ABM TREATY

Senator JOHNSTON. Well, if working on the hardware may be a breaking of the treaty, it may be a deployment or it may be testing, or at some point it may be, that's what we want to know. Because that treaty is valuable. And we want something more than a will-o'-the-wisp out there if we're going to break the treaty.

That's why we want to assure ourselves with this language. Because you can't tell me at this point whether what you plan to do in this administration would in fact be inconsistent with the treaty.

General ABRAHAMSON. Let me give you just with one example which I believe may be instructive at least just what kind of problem this whole thing creates.

Quite early after the signing of the treaty, in an exchange in the Senate, there was a discussion of, what makes the difference between an intermediate range nuclear weapon and an ICBM.

And surely one of the factors that is laid out quite carefully is the range. However, in terms of testing, and testing in an ABM mode, or something that may be capable of acting in one place or another, people were asked, what's the difference in terms of testing against a warhead on the way in?

The answer that was given had to do with the speed at which the warhead was coming in. Now, that was an appropriate answer at that point in time, because the short range types of systems they happened to have the characteristic, the weight of the warhead versus the drag of the warhead, that they came in slower than some of the ICBM's.

Now that was a judgment. That was never discussed with the Soviet Union. That was a judgment that was made. And because it was made at a high level, it was used as a guide in the whole process.

But is that the difference between a short range nuclear armed ballistic missile, or a warhead from a short range nuclear armed ballistic now? Is that the way they're making those warheads now? Does that apply now?

This is a much more complex question. And the question of what is ABM-capable is something we work very, very hard at in order to assure ourselves that we're doing exactly what you're saying, and that's staying within the policy and within the treaty.

Senator JOHNSTON. Well, if that is so, why not assure skeptics like me by letting us put on language, endorsing the language that says: None of the funds herein may be used to deploy or test or take any other action which would have the effect of breaking the strict interpretation of the treaty?

General ABRAHAMSON. Well, my response to that must be that that's a policy decision that's reserved for the President of the United States, not me.

You asked me the question earlier in a narrower sense, and that is the technical implication. And that's the one that I'm trying to answer——

Senator JOHNSTON. No, I was asking the question precisely on that language, because that's precisely the direction that I'm heading in unless persuaded otherwise. And I wait to be persuaded.

Thank you, Mr. Chairman.

Chairman STENNIS. Yes, sir, thank you.

CONCLUDING REMARKS

General, do you have anything else you wish to say? Any other point that you want to make?

General ABRAHAMSON. I wish to thank you, Mr. Chairman. I think you've allowed me to try to spend a lot of time illustrating an important part of the program; recognize that it is only part of the program.

And in fact, I appreciate the courtesy of all of the Members. While they're asking some good, tough questions—and that's fine; that's what this is about—I appreciate very much the fact that I was allowed to try to answer them and deal with them effectively.

It was a great privilege being before you.

Chairman STENNIS. Well, I've already thanked you twice, but I want to thank you a third time.

Senator JOHNSTON. And I will thank you, too.

General ABRAHAMSON. Thank you, Senator.

Chairman STENNIS. And those that assisted you. I think you made a real contribution to our resources in the field of military preparation.

SUBMITTED QUESTIONS

The request for submitted questions made throughout the hearing has been agreed to. Those questions and answers will be inserted in the record at this point.

[The following questions were not asked at the hearing, but were submitted to the Department for response subsequent to the hearing:]

QUESTIONS SUBMITTED BY CHAIRMAN STENNIS

QUESTION. What are your most important program priorities, and what would be the impact of any funding cuts on SDI this year? How would your research be delayed and what does that mean for confidence in your work? What projects would you be forced to end which would be unwise to terminate?

ANSWER. The most important priority for the SDI is to carry out a vigorous research and technology development program to demonstrate SDI technology and to provide the widest range of defense options possible. That can only be achieved with a significant increase from the level of funding appropriated in fiscal year 1987. Substantial reductions in the fiscal year 1988 budget request will have a severe impact on overall objectives and will result in a delay in the time when a defensive system could be operational. While it is premature to attempt to forecast precise program changes, if the budget was significantly reduced, various integrated experiments would be delayed and technology base research would be scaled back to address only certain critical issues.

QUESTION. Have the Joint Chiefs of Staff established yet a validated military requirement for an early SDI deployment in the 1993-94 time period, and can you tell us -- in more specific detail than your statement -- what technological progress has occurred since December 18, 1986, to support this major shift?

ANSWER. First, there has been no major shift in the SDI research and technology development program. The Program goals and objectives have remained constant -- to conduct a vigorous research and technology development program to demonstrate SDI technology and to provide the widest range of defense options possible. A formal military requirement for strategic defenses has not been established, but the Joint Chiefs of Staff are reviewing the analyses which have been prepared to date and could establish such a requirement. The Department has provided to the Congress a detailed report on potential contributions of SDI technologies to defensive missions and functions.

QUESTION: General, you have had the benefit of at least two important studies into the cost and schedule for early deployment options -- your own "Zero-One" Study and the Air Force Space Division's recent "Phase One Architecture Study." What do these studies say about when the President and Congress must decide early deployment, when initial and full operational capabilities can be achieved and at what cost, and what level of risk exist -- high medium or low? Do you

disagree with these studies, and if so, what are your answers to these central SDI questions?

ANSWER: The Secretary of the Air Force commissioned an Air Force Study to analyze the Zero-One Architecture from their viewpoint. The Air Force Study is still underway, and we are working together to identify and clarify the technical issues which will significantly effect cost and schedule.

The Zero-One Study produced analyses of what could be done with time phased, sequential deployment of the elements of a U.S. Strategic Defense System. The initial deployment of a phased deployment is not the same as an early deployment.

The Zero-One Study did show, however, that with Presidential, Congressional, and Public support beginning immediately, the initial phase of the SDS could be in place in the early-to-mid 1990's. The cost of the first phase was estimated to be roughly $40-60 billion, and the risk was medium due to the level of concurrency assumed in the development and production timeliness.

I support the results of the Zero-One Study within the assumptions made for that study. However, as work progresses and possible systems are better defined, these estimates will be revised accordingly.

QUESTION. You have said it will cost $40-$60 billion just for a "thin" ABM system, you have characterized as the first phase or early deployment system. When would Congress need to appropriate these funds for early deployment, and over how many years, and does this mean many billions more annually in a budget that already is constrained?

ANSWER. Cost is an important component of the SDI Program and cost research is being pursued concurrently with technology research. Actual costs of initial defensive deployments will be subject to a range of factors, including the nature of the Soviet threat, the timing and structure of SDI testing, and the precise size and characteristics of initial defensive deployments. In addition, the SDI is pursuing a wide range of cost-saving new technologies, production methods and management techniques which will significantly reduce the costs of actual deployed systems. Taking account of all those factors, the estimate of $40-60 billion is reasonable, although it is not a final one. It is likely that Congress would be requested to appropriate funds for strategic defenses as part of a detailed budget request, but only after appropriate decisions were made regarding development and deployment.

It is important to qualify that cost estimate, however. As concept definition is further refined, cost estimates will be refined correspondingly. While the cited figure is valid on the date of this hearing, it may change in the future.

QUESTION: You failed to submit a report estimating SDI costs and cost goals with the Fiscal 88/89 budget request, although such a report was required by law. Will you be able to provide this comprehensive report to Congress before the end of calendar year 1987?
ANSWER: An interim status report was provided on 12 May 1987. The full report will be provided in February 1988.

QUESTION. The President has asked you to provide him -- by April 30, 1987 -- with a detailed plan for a completely restructured SDI program which pursues early deployment options and is based on the broader interpretation of the Anti-Ballistic Missile (ABM) Treaty. What changes do you envision would need to be made in your fiscal year 1988 and 1989 funding requests we are considering, and to SDI's budget projections for the rest of the five year defense plan (through fiscal 1992), to implement such a restructured program?

ANSWER. The report deals with how the application of the broad interpretation of the ABM Treaty as the guideline for our SDI research program could give us greater confidence in our test results, help us achieve our goal of deployment of a system to defense against ballistic missiles and reduce costs in the program. However, the SDI research is structured and budgeted within the traditional interpretation of the Treaty, and will remain so structured unless the President provides new direction.

Question: What are the key scientific, technological, and industrial base challenges which must be overcome to permit an early deployment system to go forward, and what capabilities do we not now possess which are critical to deciding to enter development of an early deployment system, and to actual early deployment? What is the risk level associated with overcoming the challenges in each area--high, medium, or low--and by what year do you expect to have identified and demonstrated the solutions to each key challenge?

Answer: Before specifically addressing the issues of challenges, critical capabilities, and risk assessment, it must be emphasized that the SDIO is pursuing a phased, or incremental, deployment of a defense capability, as opposed to any sort of "early" deployment, as mentioned in the question. In a phased deployment of a defense, the first deployment is the initial phase of an evolutionary system. It would provide a base upon which the more capable, follow-on system would be built. Each phase would be given sufficient capability to achieve specific military deterrence and policy objectives.

The key scientific, technological, and industrial base challenges which must be overcome to permit the initial phases of an incremental deployment to go forward can be grouped into two categories. In the area of science and technology, critical capabilities must be pursued in navigation, guidance and control; data/signal processing; communications; radar; electro-optics/optics; materials and structures; propulsion; power; thermal control/management; and the space environment. Integrated technology areas which need to be advanced include manufacturing/producibility; survivability; test and evaluation; and supportability and logistics. All of these areas represent important challenges which are associated with one or more of the systems that are under consideration for the initial stage of a phased deployment.

The discipline of evaluating the technical risks, or confidence levels, associated with a given program involves subjective judgments. It is possible to reduce the level of subjectiveness involved in program risk assessment by imposing a somewhat arbitrary "confidence scale" or rank ordering based upon the level of scientific and engineering maturity actually demonstrated to date. An example of such a scale is presented in Table 1 below. Since any system will incorporate a number of technologies, one must also construct a method for synthesizing the confidence levels assigned to the individual technologies into an overall confidence level for the entire system.

The SDIO is in the process of developing a risk assessment methodology that is more analytical than a simple subjective estimate of "high," "medium," or "low" risk. We are doing this as part of our preparation for a "Milestone One" presentation to the Defense Acquisition Board (DAB). We must insist on a high degree of credibility for all incorporated technologies at the time a decision is made to proceed with system level development (i.e. DoD Milestone II) of the Phase I system, along with an appropriately high degree of credibility for those technologies required for following phases

TABLE 1

TECHNOLOGY READINESS RISK LEVELS IN AN R&D PROGRAM

LEVEL	TASK	DESCRIPTION
1	Scientific Research	Basic principles observed and research reported
2	Conceptual Analysis	Conceptual design formulated
3	Proof-of-Concept	Conceptual design demonstrated analytically or experimentally
4	Technology Validation	Critical technology subsystems validated in relevant environment
5	Engineering Integration	Integrated component/subsystem/system validation experiment completed in in ground or space environments
6	Preliminary Engineering Design	Fabricate engineering model and qualify, and/or integrate test system level performance requirements
7	Engineering Validation	Design, fabricate, and test prototype

8	Engineering Design Assurance	Demonstrate component/subsystem/system design assurance, involving adequacy of the engineering characteristics of each
9	Engineering Manufacturing	Manufacturing techniques scaleable to peak production and affordability goals successfully demonstrated
10	System Deployment	Deploy first operational article. Obtain sufficient operational experience to validate deployed performance and sustainability (including training).

QUESTION: SDI has a "Red Team" which analyzes likely Soviet responses to various U.S. missiles defense deployments. Do the results of the SDI Red Team analyses indicate that the type of early deployment system being contemplated would be cost-effective at the margin, in that cost-effective Soviet countermeasures would not be available by the mid 1990s give a concerted effort to overcome the U.S. system?
ANSWER: During the past year, four technical Red-Blue Team analyses were conducted to assist in improving understanding of countermeasures by both SDIO system concept and technology developers. The High Endoatmospheric Defense System (HEDS) analysis addressed the terminal defense region. The Ground-Based Midcourse Interceptor (GBMI) analysis addressed the midcourse region, and the Space-Based Interceptor (SBI) analysis addressed the boost and post-boost phases of the overall strategic defense engagement. The Architecture Red-Blue analysis is considering the entire engagement region and will review the results of the other Red-Blue analysis and examine how an offensive force planner might attempt to balance countermeasures over the entire engagement.

[Deleted.]

The Ground-Base Midcourse Interceptor and Space Based Interceptor Red-Blue interactions were initiated to examine midcourse and boost/post-boost defenses. On Red-Blue exchange has been conducted in support of each analysis. The following paragraphs describe the current status of that work.

[Deleted.]

Both the GBMI and SBI analyses are in their early stages. Other possible defense systems countermeasures and time periods must be examined before major conclusions are drawn.
The Architecture Red-Blue analysis has only proceeded through the first half of its initial interaction. The Red Team has postulate several countermeasures which may be effective against several defense layers. The Blue Team is now studying these countermeasures and assessing their effectiveness. It is too early in the process to draw conclusions.

[Deleted.]

The SDIO process has resulted in an improved understanding of countermeasures and countermeasure responses. New ideas for countermeasures and countermeasure responses were identified, evaluated, and are being considered in both technology and system design.

[Deleted.]

Significant results from initial analyses have been identified, and requirements have been developed for additional analysis by the Red and Blue Teams. Round I efforts have resulted in defense system designs that are more robust to possible Soviet countermeasures, and it is expected that the second round of analyses will produce additional significant modifications to the defense system designs.

QUESTION. The Defense Department told the Congress this February that, because of congressional budget cuts, the SDI program had slipped by one or two years in its ability to provide the nation with sufficient information to decide whether comprehensive missile defenses are feasible. If true, why wouldn't this delay the program's ability to examine sufficiently any early deployment options, as well as to examine the feasibility of the futuristic missile technologies your own statement indicates may be necessary to prevent the Soviets from employing countermeasures which would make the early deployment system obsolete?

ANSWER. Budget reductions have in fact delayed progress across the entire SDI Program. As I have stated on a number of occasions, the SDI research pace is not technology limited, but funding limited. If the Program continues to experience budget reductions on the order experienced in fiscal year 1987, we will continue to push back the point where we will have satisfactorily addressed all the unknowns about strategic defenses. The initial phases of a potential strategic defense would consist of the more mature technologies, and, hence, budget reductions have had a relatively lesser impact on those options.

QUESTION. SDI critics contend that the experimental and technological results that the Pentagon says are either significant breakthroughs or have already established the feasibility of certain defensive systems are not a convincing demonstration of an operational system -- with the reductions in size and cost, and increases in complexity, battle management capabilities, and numbers of weapons that an operational system would require. How would you respond to these contentions?

ANSWER. At the subsystem level, we have demonstrated many capabilities which when integrated to the system level should yield very promising results. However to convincingly demonstrate operational capability for a system of strategic defenses, one must conduct a series of experiments which integrate various subsystems and technologies, and address the parameters you suggest and others. With the substantial budget reductions levied on the SDI Program, many of those experiments have been pushed back. The restrictive interpretation of the ABM Treaty also provides a major constraint on the SDI testing programs. The differences between an SDI program which continues to be conducted under the restrictive interpretation of the Treaty, and a restructured program that we could pursue under the broad interpretation, are significant. The broad interpretation would permit us to delay by several years a decision on fundamentally altering the ABM Treaty regime until we had confidence that the technologies which we had developed would meet our criteria for deployment. To achieve an equal level of confidence in defense feasibility under the restrictive interpretation, the United States would be forced in the future to make a decision to alter fundamentally the Treaty regime simply to conduct the tests necessary to enter into full-scale engineering development. The broad interpretation would allow the program manager to design more realistic tests to integrate weapons, sensors and battle management/command, control and communications. The broad interpretation would reduce costs significantly and allow for greater efficiency. We estimate that it would save two years in the research program and at least $3 billion in establishing the feasibility of an initial defense against ballistic missiles. The broad interpretation would allow the United States to retain the option to decide to deploy strategic defenses in the mid-1990s. Even under ideal conditions, the restrictive interpretation would delay deployment until the late 1990s.

Question. What major shifts in emphases and objectives including major accelerations and slowdowns in both the overall SDI program, and in each of the five major sub-programs, are reflected in the fiscal 1988 and 1989 budget requests and projections through fiscal 1992, and how do these changes compare with the program emphases projected in the fiscal 1987 budget for these two fiscal year and fiscal 87-98?

Answer. The FY87 budget request addressed the requirements of an early 1990s decision milestone. The basic building blocks of the program consist of a technology development program and technology validation efforts to confirm feasibility.

The strategy to absorb the Congressional reductions to the program was to protect initial deployment options, reduce technology validation efforts and slow technologies dealing with the responsive threat.

As a consequence of Congressional action on the FY87 budget request, all program elements were reduced. As an example, the major impact on the Directed Energy program was to terminate a major excimer laser project and delay the Neutral Particle Beam Integrated Space Experiment by about two years. These efforts represented secondary approaches within Directed Energy. The ground based free electron laser represents a principal option and funding for this effort was only slightly reduced.

The $3.2 billion appropriated permits only limited technology development for the entire multilayered defense and responsive threat. As a result, overall system performance risk has increased, technical validation schedules for some systems were seriously impacted, e.g. SSTS, BSTS, TIR, NPB, EML, etc., and work on midcourse surveillance and discrimination for the responsive threat has been delayed.

Question. How are these shifts reflected in terms of budget dollars, experiments, etc., and how have program funds been redirected to emphasize research with early deployment potential? On what basis was each major shift made - - technological progress, Congressional budget cuts, policy decisions, etc.?

Answer. The severe FY87 funding reductions forced the SDI program to narrow its options, with fewer options available to narrow in some areas than others. As a consequence of Congressional action budgets, all program elements were reduced in FY87. The funding adjustments made are as follows:

FY87 BUDGET REQUEST
($ IN MILLIONS)

PROGRAM ELEMENT	FY87	FY88	FY89
SATKA	1262.4	1558.3	1816.7
DEW	1615.0	1582.0	1843.3
KEW	991.2	1217.2	1418.3
SYSTEMS	462.2	564.0	658.8
SLKT	454.4	523.7	662.5

FY88 BUDGET REQUEST
($ IN MILLIONS)

PROGRAM ELEMENT	FY87	FY88	FY89
SATKA	911.0	1492.7	1859.5
DEW	843.6	1103.7	1245.8
KEW	729.6	1074.7	1199.7
SYSTEMS	386.9	627.3	787.5
SLKT	338.0	900.4	1162.2

PROGRAM CHANGES
($ IN MILLIONS)

PROGRAM ELEMENT	FY87	FY88	FY89
SATKA	-351.4	-65.6	42.8
DEW	-771.4	-478.3	-597.5
KEW	-261.6	-142.5	-218.6
SYSTEMS	-75.3	63.3	128.7
SLKT	-116.4	376.7	499.7

The appropriation was a reduction in excess of 30% of the request. Clearly, a reduction of that amount must be applied across the entire program. In general, the result was to reduce technology validation efforts and slow technologies dealing with the responsive threat. The requested growth in the SLKT line reflects the need for increased investment in space transportation issues. The proposed increase in Systems reflects the need to restore the critical balance between technology development and validation.

Question: What is the justification for the large increase in the percent of DoD SDI budget devoted to survivability, lethality and key technologies in the FY 88 budget request from the percent of SDI's budget projected in the FY 87 budget request for those activities in FY88? What significant progress in the specific areas accounting for the increase have occurred in the past year to justify the increased emphasis and change from previous projections? What new, unexpected requirements for research in these areas have emerged in the past year which justify this change? If no new requirements have emerged, explain why this change is justified.

Respondent: Most of the increase is for concept definition studies and development of the needed technologies associated with the development of the Advanced Launch System (ALS). The on-going joint NASA and DoD Space Transportation Architecture Studies (STAS) have concluded that the U.S. will require additional launch capability in the next decade and such a system should have goals of reducing launch costs and increasing launch capacity and flexibility to provide a launch base to meet future launch requirements. The STAS contractors have indicated that an ALS could be developed by the late 1990s that could provide an order of magnitude cost savings for launch operations compared to current systems. The nation's newest launch system, the Space Shuttle, is based on 15 year old technology and our expendable booster technology is even older. To remain competitive in the international space arena, the U.S. must modernize its launch structure. In FY88, the SDIO is increasing technology development for an ALS begun in FY1986. Concept definition studies initiated in FY1987 will lead to validation contracts beginning in FY1988. The ALS will be designed to meet national launch needs in the mid-1990s and will utilize a design which can evolve to enhanced capabilities and reduced operations costs in the late 1990s.

QUESTION. The FY 88 SDI budget request devotes about 50 percent of the total weapons research funds to Kinetic Energy Weapons (KEW) and about 50 percent to Directed Energy Weapons (DEW). Last year, however, the FY 87 budget request projection for FY 88 showed that only about 44 percent of the weapons funds would be devoted to KEW, while 56% were to be devoted to DEW. What is the justification for this change in research emphasis and what lack of progress in the DEW program in the past year would justify this shift in emphasis?

ANSWER. The change, since the last fiscal year projection for the FY 88 budget, is the substantial reduction in the FY 87 budget. Recall, the SDI Program was appropriated over 30% less funds than requested. Clearly, a reduction of that magnitude must result a series of changes in the planned structure of the research program upon which the next year budget projections had been estimated. One result of applying the budget reductions was the small, but noted, shift in distribution of requested funds between the KEW and DEW programs.

QUESTION. As late as June of last year, your SDI annual report (1986) said the program could stay within the narrow interpretation of the ABM Treaty and still provide sufficient information to the nation to determine the feasibility of strategic defenses and permit a development decision in the early 1990's. This would imply that compliance with the narrow interpretation could be maintained through that period, not just for another year, as you have just indicated. General, please explain this apparent contradiction in your statements?

ANSWER. There is no contradiction. By restructuring the SDI program to the bounds of the broad interpretation, our fundamental goal of determining the feasibility of advanced technologies for a BMD role can be accomplished more quickly, directly and efficiently. This would result in financial savings and provide greater confidence through realistic tests using the most capable hardware available. In short, the legally correct interpretation permits a more accurate and reliable assessment of defense feasibility. Because of the ambiguities and the self imposed restrictions inherent in the restrictive interpretation, we would be forced to do piece-meal tests in a less realistic setting. This problem is avoided by adopting the broad interpretation.

QUESTION: Please provide for the record the detailed justification that continued compliance with the traditional interpretation of the ABM Treaty could add about $1 billion and 2 years to the cost and schedule of developing the Boost Surveillance and Tracking System.

ANSWER: The traditional or restrictive interpretation (RI) of the Treaty will limit the [deleted] [deleted]. To test these critical boost phase functions will require that another satellite be flown with these capabilities and the time frame and cost for this "next" satellite is approximately $1.B and 2 years.

Question. Please identify the new starts contained in SDI's fiscal 88 and FY 89 budget requests, by dollar amount and project name, and please show the funding projected for each annually in the FY 88-92 five year defense program.

Answer. There are no new starts contemplated in the FY88 and FY89 budget requests.

Question. What were the impacts of reductions in the FY 87 budget request in terms of major programmatic adjustments and effects on specific, major scientific and technology efforts. Did SDIO continue the past practice of allocating cuts in balanced manner across all programs, or disproportionately concentrate cuts, and, if the latter case, why?

Answer. The appropriation was a reduction in excess of 30% of the request. Clearly, a reduction of that amount must be applied across the entire program. In general, the result was to reduce technology validation efforts and slow technologies dealing with the responsive threat.

The $3.2 billion appropriated permits only limited technology development for the entire multilayered defense and responsive threat. As a result, overall system performance risk has increased, technical validation schedules for some systems were seriously affected, e.g. SSTS, BSTS, TIR, NPB, EML, etc., and midcourse surveillance and discrimination for the responsive threat has been delayed.

QUESTION. What major scientific/technological progress occurred in each of five major sub-programs during the past year, and what are the implications of this progress for the feasibility of developing/deploying either partial, early strategic defenses or thoroughly reliable, later strategic defenses? What is the magnitude, complexity, cost and time period of the remaining work required in each particular area to translate these results into deployable, effective defenses -- for both the early and later deployment options?

ANSWER. The recently published (April 1987) SDI Report to the Congress includes a detailed description of the technical objectives for each of the subprograms, their significant accomplishments, and an overview of how each program is structured. Additionally, that report relates the technological progress which has been made to the concept of phased deployment. Further, a May 5, 1987, report to the Congress on the SDI "Deployment Schedule" discusses strategic defense technologies for evolutionary deployment and their potential contributions to other military missions.

QUESTION: Regarding early deployment SDI options, please explain why each is more feasible in the past six months than when the 1986 SDI Annual Report to Congress was submitted last June, and provide the specific architectures under consideration, including (for each):

- The numbers of sensors, weapons, battle stations, concept of operations, likely cost to deploy and to operate annually, timetable for deciding, and for deployment, IOC, and FOC;
- The ability of each early deployment option to satisfy the "Nitze criteria" for strategic defenses of 1) military effectiveness in the face of a responsive threat, 2) survivability in the face of a responsive Soviet threat, and 3) cost effectiveness at the margin.
- The required levels of effectiveness and survivability in terms of kill probabilities and years before obsolescence for each early deployment options, and whether these requirements have been reduced since the components now being considered for early deployment were included in the more comprehensive, thoroughly reliable strategic defense systems contemplated for later deployment;
- The likely Soviet countermeasures to each option and cost and time for the Soviets to deploy such countermeasures;
- The remaining scientific, technological, engineering work required to overcome the principal remaining challenges under each option, and the timetable, cost, and degree of risk(low, medium, high) to overcome each;
- The ability of American industry to produce at low cost in high volume, and within required time frame, the sensors, weapons and battle stations required under each deployment option;
- The status of, and time table for, the Joint Chiefs of Staff to identify specific missions early deployable strategic defenses could perform, and to develop and validate a formal military requirement (and formal requirements document needed for a full scale development decision) for such defenses.

ANSWER: Given a national decision to proceed with full scale engineering development, an effective strategic defense system would be based on technologies available within the next ten years. It would also be designed to provide for growth, both by making allowance for further technological improvements and by the addition of later supporting layers or systems. Thus, a near-term system would be but a first phase of an eventual total defensive system. As currently conceived it would consist of multiple layers to increase the probability of preventing a successful missile strike, and could be constructed as follows: a boost phase layer combining the Boost Phase Surveillance and Tracking System (BSTS) and Space-Based Kinetic Kill Vehicle (SBKKV); a midcourse layer using sensors to detect the attacking elements after they have separated from the missile and provide data for the Exoatmospheric Reentry Vehicle Interceptor System (ERIS); a terminal layer could augment earlier layers with airborne optical sensors, ground-based radars and the High Endoatmospheric Interceptors (HEDI); the entire layered defense would be managed and directed by a decentralized BM/C3 system.

The technical progress that has been made on the SDI research program over the past three years has advanced at an unexpectedly fast pace and is still accelerating. We remain convinced that the basic goal of the SDI Program is achievable. It is most likely that future decisions on deployments could have to be made on the basis of defensive options, each which would provide increments of protection from ballistic missile attack. This evolutionary approach to strategic defense is known as the concept of phased, or incremental, deployment. Recognizing the fact that no strategic defense system could be deployed all at once, this concept of phased deployment addresses the question of how to deploy strategic defenses in the event of a deployment decision is made in the future. It does not constitute a decision to deploy. Such a decision can not be made now. We continue to believe that the defense resulting from the various increments must be expected to meet our basic criteria of military effectiveness, survivability and cost-effectiveness; thus, the development and deployment of the initial phase of an evolutionary system should provide a base upon which the larger, integrated system can continue to be built and should perform a militarily useful function that contributes an increase in our security commensurate with the commitment of resources involved. This would also increase arms control negotiating leverage for balanced reductions in offensive weapons.

The goals of defense deployments are: (1) deny the Soviets confidence in the military effectiveness and political utility of a ballistic missile attack; (2) secure significant military capability for the U.S. and its allies to deter aggression and support their mutual strategy in the event deterrence should fail; (3) secure a defense-dominated strategic environment in which the U.S. and its allies can deny to any aggressor the military utility of ballistic missile attack.

It has become clear that these goals can be reached through the phased deployment of defenses, and that incremental deployment of defenses is the only likely means of deployment. Each phase of deployment would be sized and be given sufficient capability to achieve specific military and policy objectives and to lay the groundwork for the deployment of subsequent phases. Of equal importance, the technologies employed in, and objectives served by, the initial phases of a deployment would be fully compatible with the technologies and objectives of the ultimate strategic defense system. In fact, such early phases would facilitate the achievement of the ultimate system.

In addition, the first phases could serve an intermediate military purpose by denying the predictability of Soviet attack outcome and by imposing on the Soviets significant costs to try to restore their attack confidence. These first phases could severely restrict Soviet attack timing by denying them cross-targeting flexibility, imposing launch window constraints, and confounding weapon-to-target assignments, particularly of their hard-target kill capable weapons. Such results could substantially enhance deterrence of Soviet aggression.

Technologies available for a first layer of defense in the boost phase are:

o Space Based Phase Surveillance and Tracking System (BSTS): An orbiting launch warning satellite in high earth orbit that would use various sensors to perform launch detection, booster identification, and booster track prediction functions. This type of system could perform surveillance and warning functions. Information from the BSTS satellite would be passed on to other SDI systems, such as the Space Surveillance and Tracking System (SSTS), Probe, Airborne Optical System (AOS), or Space Based Kinetic Kill Vehicle (SBKKV).

o Space Based Kinetic Kill Vehicle (SBKKV): This is a space-based system which would use sensors hand over information to orbiting platforms containing kinetic energy weapons. The kinetic energy weapons would use sensors to home on boosters, post-boost vehicles, or anti-satellite systems.

The midcourse layer of defense could initially be supported by the following technologies:

o Ground-Based Late Midcourse Sensing Platforms: Missile-borne surveillance technologies consist of on-board infrared sensors to perform discrimination and tracking functions. These "Probes," as they are called, would be used in conjunction with other elements, such as the Exoatmospheric Reentry Vehicle Interceptor System (ERIS), Airborne Optical System (AOS), and Ground-Based Radar (GBR).

o Ground Based Exoatmospheric Reentry Vehicle Interceptor System (ERIS): The ERIS concept is a multi-stage kinetic kill system used to destroy incoming warheads. An on-board seeker would be used to home on the targets, based on target information given to it from other SDI sensor elements. Advanced versions would have improved capabilities.

The technologies first available for a terminal layer capability are:

o Ground Based High Endoatmospheric Interceptor Missile (HEDI): This interceptor could be used for terminal defense and to engage RVs remaining from the midcourse phase of the defense. The interceptor would accept handover data from other systems. It would use an on-board seeker to home in on the terminal-phase targets and could be used to destroy RVs from several kinds of ballistic missiles.

o Ground-Based Radar (GBR): This radar is a fixed discrimination and tracking system used for the terminal phase portion of the defense. An improved version of the system, incorporating software and processor upgrades to enhance its discrimination ability in order to accommodate increased threat sophistication, would follow.

Coordinated performance in each phase, together with the integration of a multitiered defense, is the responsibility of the Battle Management and Command, Control, Communications elements of the system. An initial capability to manage the defensive battle and command, control and communicate with high confidence during all phases of the defensive engagement involves decentralization. Specific requirements would include boost phase sensor broadcast of track information with distributed command and control on the engagement platform. This capability will grow incrementally to the point that full functionality for ground-based elements and the initial capability to manage boost phase spaceborne sensors and weapons will be demonstrated, then further evolved to establish full battle management functions. Validation of system and battle management architectures will be accomplished within the environment provided from the SDI National Test Bed (NTB) program, which will achieve an early operational capability in 1988. Capabilities to be developed concurrently with battle management prototypes are those associated with a strategic defense command center which will provide techniques for human control of a strategic defense system. A successful SDI architecture must be premised on the understanding that it would accommodate present and future U.S. strategic needs and be responsive to Soviet countermeasures. The Soviet threat is considered to exhibit an evolving capability that can be characterized by non-responsive and modified systems over the near term, moving toward more directly responsive countermeasures in the longer term. A U.S. defensive architecture must allow development of cost-effective defensive capability even in the face of an aggressive strategic countermeasures program.

The task is to meet these requirements with an appropriate level of technology by deploying an evolutionary and time-phase architecture. This architecture would be comprised of ground, air and space-based systems within a framework that maximized the leverage of the U.S. defense posture over existing threat and plausible near-term countermeasures. Development and deployment of a time-phased defensive system would enable the US to counter an evolving Soviet strategic threat with systems that would erode Soviet confidence in their strategic offensive forces while enabling US strategic planners indirectly to cause Soviet weapons acquisition programs to deemphasize strategic offensive programs and increase the emphasis on strategic defensive programs.

The Strategic Defense Initiative Organization (SDIO) investment strategy which pertains to these program elements is characterized by three objectives: (1) bringing the most mature technologies to a level where, if the decision were made to proceed, the tasks of realizing the individual system concepts would primarily be one of engineering; (2) pursuing development of emerging technologies having the potential for major improvements in defense effectiveness; (3) ensuring investments are made in innovative ideas which, although they present higher technical risk, hold the promise of great success and could yield significant payoffs in achieving a thoroughly reliable defense. This program is based on an overall systems approach and complementary systems design in lieu of an alternative and possibly suboptimized approach in which individual technologies, systems and missions are instead given isolated focus.

Follow-on technologies are essential to enhance survivability, cost effectiveness and military effectiveness, as well as to provide responses to possible Soviet countermeasures. In the field of sensors examples of advanced technologies now being explored include: a space-based surveillance and tracking platform, which enables more accurate tracking and discrimination, a space-based radar, and the airborne optical sensor, which could augment target tracking capability in the late mid-course. Follow-on weapon candidates include space-based and ground-based directed energy devices, which are very valuable as interactive discrimination devices as well as weapons, and which could significantly enhance the effectiveness of the boost-and mid-course phases of the defense; and ground-based hypervelocity guns, which could be used for highly effective terminal defense.

Question. What is the status and timetable of completion of the following SDIO analyses, regarding both early and later deployment options:
1) of logistics support required to maintain such defenses;
2) of basing, siting, and environmental impacts of deployment of both deployment options;
3) identification of producibility and industrial base needs for deployment of early and later strategic defenses;
4) of SDIO effort to establish "independent" cost analysis capability. Also, what is the justification of SDIO's need for an "independent" cost analysis capability instead of using existing Air Force or Defense Department capabilities, especially OSD PA&E's Cost Analysis Improvement Group (CAIG).

For each of the first three analyses, please provide a summary of the key issues to be addressed.

Answer. 1) Analyses of the required logistics support are being done at the programmatic (SDIO) level by the System Architecture Contractors and a Supportability Contractor, and at the Service and individual system level by Service Supportability Contractors and System Contractors. These efforts are analyzing a full range of phased deployment options.

The Architecture Contractors will provide a description of the System Life Cycle support for their candidate architecture(s) including a Supportability Concept and a preliminary Integrated Logistics Support Plan. These outputs will be provided during the twelve months following the 8 Sep 87 contract award date.

The SDIO Supportability Contractor was awarded a two year contract on 8 Sep 86 to do Logistics Support Analysis (LSA) for SDIO. The contract includes provisions for Initial Reports, Updates, Draft Final Reports, and Final Reports for selected LSA tasks. The Initial, Updates, and Draft Final Reports will be delivered at approximately 6 month intervals to allow for successive analyses as SDI options evolve.

Individual system contractors will provide logistics support requirements at a level dependent on the status/maturity of their programs. The supportability implications of each program will be considered in detail as part of any Full Scale Engineering Development decision, and analyses will be part of Demonstration/Validation Phase efforts.

The U. S. Army Strategic Defense Command (Huntsville) will provide a Maintenance Plan by 3QFY87 and a Supportability Approach Plan by 4QFY88 covering systems under their purview. The Air Force Space Division is developing a Basic Logistics Support Model (due 4QFY87) and a Program Support Plan by 1QFY89. Interim capabilities are being developed to allow for initial analysis as required.

2) Analyses of research, technology validation, and initial investigations are being performed by the executive agencies designated for each of the major technologies being investigated for applicability to an SDS. The siting of the experiments is predominantly in existing laboratories with experience in the technologies of interest. Environmental analyses have been conducted where required for the research and technology verification tests.

As the SDI moves through the research and development process toward potentially usable components, the siting, basing, and environmental process will occur when required to allow for informed decisions on major programs. At present, the SDIO is directing a program of environmental analyses of technologies which may be proposed for further demonstration and validation, particularly those in an initial increment.

Subsequent to a decision for demonstration and validation, but prior to any decision process on full scale engineering development, potential site and base selection studies will be conducted with environmental impact analyses of the alternatives being included as an integral part of the site and base consideration. The site and base analyses and associated environmental analyses will be conducted by the best informed organizations in a technology or system; the expectation is that most of the site and base selection analyses and environmental studies will be conducted by the cognizant system program managers.

The analyses on potential sites, bases, and the alternatives, as well as the environmental analyses, will be conducted prior to any full scale engineering development decisions on major components of a Strategic Defense System. Similarly, the analyses will be extended and refocused on the issues which relate to a deployment decision that may be taken subsequent to the full scale engineering development decision.

Within the limits of national security, the siting, basing, and environmental impact analyses process will be conducted in the open context envisioned by the National Environmental Policy Act.

3) The level and detail of producibility and industrial base analyses has been a function of concept and design definition available in many SDIO architecture studies. In most cases, architecture level concepts only lend themselves to macro, "top-down" analyses that focus on the ability of the US industrial base to transition a number of new, key technologies from R&D into efficient production. Because SDIO is considering

a number of architectures that make use of many new technologies (as well as alternative technologies), our producibility analysis has concentrated on the time and resources needed to scale-up nascent industries to meet the high volume, reduced cost objectives of SDI. In FY87, we have identified technologies key to the function of several potential SDI elements (IR Focal Plane Arrays, Precision and hardened optics, light weight structural materials, more efficient launch vehicle production, cryo-coolers, etc.). We are continuing our analysis to identify industrial base capacity constraints and inefficiencies. This analysis will be iterative and will not ever be "complete" as producibility and industrial base improvement will be key features of any SDI acquisition strategy. This acquisition strategy must make the best use of SDI funds to leverage industry investments and influence industry management if any SDI architecture is to be producible and affordable.

A good example of the producibility analysis being accomplished by SDIO is the work recently completed by Booz, Allen and Hamilton which provided detailed assessment of the producibility issues regarding infrared focal plane arrays (IRFPA's) and optical telescope assemblies. This study identified opportunities to decrease total system costs by improving the manufacturing planning processes as well as introduce new manufacturing technologies. The study analyzed current manufacturing capabilities of Santa Barbara Research (IRFPA's) and Perkins-Elmer (telescopes) and developed "business as it should be" recommendations. The study showed that early detailed production planning would be required in concert with design engineering if SDI cost goals were to be met. The availability of new technologies by themselves will be insufficient to change current high cost, R&D based, low volume-custom production operations. An aggressive incentives program will be needed to stimulate contractor investments.

4) SDIO manages the technology development and system acquisition planning of a diverse set of what would otherwise be known as "major systems." This management task requires the coordination of the efforts of industry (normally through the military services), national laboratories and foreign governments. The objective of the program is to attain the most progress in technology and system concepts that is available from limited Research and Development funds. The decisions associated with this resource allocation problem require estimation of the projected costs and performance of systems that developing technologies will enable. With this information SDIO can make near term expenditures that will return the most in the long run.

It is extremely important that SDIO's resource allocation process be supported by a comprehensive and "independent" cost analysis capability. Choices must be made which involve diverse system options, technological disciplines and government organizations. A single source of cost information must be used in order to eliminate the biases found in subordinate data bases, minimize the impact of "advocacy" in planning, ensure that comparisons between projects are made in a full and consistent manner, and allow the maximum amount of cross-fertilization of new data and ideas aimed at reducing the future costs of space defense system.

SDIO's cost analysis capability met an initial milestone in the work associated with recent archutectural studies. In support of those studies, the initial architectural cost model was created by SDIO's "Affordability and Cost Effectiveness Analysis" support contractor team (Applied Research, with The Analytical Sciences Corporation, Decision Science Associates, and Riverside Research Institute). The model is comprehensive and working, but being preliminary does not benefit from the research in producibility and future technology impacts that is ongoing. The focus provided by these studies will enable SDIO to determine the best manner in which to direct future cost analysis research.

These architectural studies are also serving as an organizing vehicle for SDIO activities involved with planning. Among other acivities, System Architecture contractors are benchmarking their cost work, and an "Independent Cost Assessment" of the current cost model is being accomplished by the Office of the Secretary of Defense/Programs Analysis and Evaluation. The results of these interactions will provide further focus to SDIO's cost analysis capabilities and needs and provide a solid basis for continued effective development of this essential management activity.

QUESTION. Can, as previously stated by the Administration, SDIO still accomplish its original objectives within the restrictive interpretation of the ABM Treaty and can it accomplish the work required to support an early deployment decision within the restrictive interpretation? How quickly after a Presidential decision to implement the broader interpretation, can SDIO take advantage of that decision in conducting research and development and testing activities, and what specific changes to the FY 88-92 FYDP and SDI program plan would be required (additional experiments, project, programs, etc., by year, along with the dollars required for each)?

ANSWER. The SDI research can proceed within the restrictive interpretation of the ABM Treaty. However, remaining within the restrictive interpretation of the Treaty will result in significantly greater cost, a longer period of research and less confidence in results than under the broad interpretation. A detailed report on this subject, in response to Section 217 of the fiscal year Defense Authorization legislation, has been provided to the Congress.

QUESTION: Please provide detailed information whether any of the early deployment missile defense architectures being considered meet all three essential criteria for evaluating SDI -- 1) military effectiveness; 2) cost effectiveness at the margin; 3) survivability -- without the deployment of additional capabilities embodied in the more futuristic missile defenses available in the systems and architectures contemplated for later deployment.

ANSWER: The three criteria will be met in any deployment of strategic defenses. Whether an initial or follow-on system, a prospective strategic defense will be judged on the basis of whether the criteria can be met in the face of the particular threat in existence when it is deployed. In addition, to be considered cost effective, it must discourage Soviet proliferation and countermeasures.

QUESTION: Please provide detailed information for the record whether, in developing those systems oriented toward early deployment, the SDI Program has altered any of the effectiveness criteria (both in terms of the three above mentioned criteria and specific contractual requirements for kill probabilities, types and numbers of targets to be engaged, trajectory phases for required engagement, years of operational effectiveness before being countered by Soviets, survivability, etc.) established for those systems earlier in the program and before the major reorientation? If so, how have these criteria been altered and what is the justification for those changes?

ANSWER: The SDI Program has not altered the definition of the three criteria. One of the criteria, military effectiveness, sets the conditions for the rest of the requirements mentioned. Once a specific military objective has been set for a system and that goal is judged to be of military utility then the performance goals necessary to reach the objective can be set. SDIO has always required its contractors to make the system requirements consistent with the objectives. It is possible to be mislead by setting strict requirements for things like kill probability. The types and numbers of specific U.S. targets held at risk are therefore somethings which change with each change in defensive systems but the overall objective is not uniquely determined by the particular choice of kill probability. The period of operational effectiveness is difficult to gauge. Our measurement is by necessity dependent on the assessment of the threat provided by the intelligence community and is ultimately determined by the adversary's technological success and willingness to attempt to develop a countermeasure. The ground rule for systems development insists that systems introduced be capable of meeting the threat at the time they are introduced but that they be resilient through system growth or tactical development to evolving threat. We are careful to avoid "Dead End" approaches. Essential to the maintenance of a cost effective program and an important feature of the advanced technology experiments planned in the near term is that by demonstrating that a solution to a countermeasure is being worked, the offense may avoid that countermeasure. For example, the effectiveness of ERIS could be reduced in the face of a threat composed of high fidelity decoys. However, [deleted]
[deleted] long before we deploy an ERIS we are developing solutions for the principal countermeasures to it. It is, however, important that the Congress appropriately fund these important technologies, otherwise it will be the Congress, not the SDIO, that will prevent a given SDI system (and its evolution) from meeting the criteria.

Question: Before the decision was made in late December, 1986, to reorient the SDI program toward early deployment, what was the annual funding SDIO allocated for heavy lift launch vehicle research in the FY87-92 five year defense program being prepared for submission to Congress as part of the fiscal 88/89 defense budget request. Please provide all HLLV funds for both the Air Force and SDIO.

Answer: The SDIO program has not been reoriented toward early deployment. The decision to increase Advanced Launch System (ALS) funding was based on long lead times to develop a low cost, high capacity space launch capability and the identification of short falls in future civil and national security space launch capability beginning in the early 1990s. The ALS will be needed to support a timely strategic defense system; however, it will still be required if strategic defenses are never deployed. Unless the U.S. modernizes its launch capacity, it will be forced to settle on becoming a second class spacefaring nation that cannot satisfy its own launch requirements, much less have an excess capacity to meet unforeseen new space endeavors. Below is the ALS funding within the current budget and supplemental request:

($M)	FY87	FY88	FY89	FY90	FY91	FY92
SDIO	159.47	289	453	586	546	703
AF	35	39	40	141	242	543

QUESTION. Provide the specific scientific, technological, engineering, cost, and schedule impacts (including changes in "informed decision" dates for FSED, IOC dates, elimination of particular technologies, effects on timetables for ABM Treaty-related experiments) on the SDI program if Congress approved real growth in FY 88 of 5%; 10%; 20%; 30%; 40%; and 50%, and with respect to both early deployment and later deployment systems. Provide alternative funding profiles for SDI for FY88-92 assuming real growth under each of those percentages in FY 88.

ANSWER. It is premature to forecast specific program changes which would be necessary if the budget request for fiscal year 1988 was limited to the several levels specified in the question. A complete analysis on restructuring the program to revised funding levels for fiscal year 1988 can only be made with knowledge of the results of the fiscal year 1987 research effort and the current (end of fiscal year) projections of the best technical and systems approaches for fiscal year 1988. However, in general, significant reductions in the budget request could result in at least the following impacts:

- Delay certain sensor experiments
- Terminate certain ground based interceptor flights
- Reduce theater defense programs
- Restructure the free electron laser and neutral particle beam programs to ground based technology only.

Such limited funding would destroy the vital balance between development of a technology base and technology validation efforts essential to support a development and deployment decision. If SDI funding continues to be limited, the U.S. will not only waste its greatest leverage--the innovation possible in a free society--but it cannot expect to do more than react to Soviet initiatives in strategic defense. If U.S. efforts to provide a thoroughly reliable defense are to be successfully carried out in a timely fashion, funding must be restored to levels that will allow the SDIO to effectively pursue options for strategic defense of the U.S. and its allies.

Question. Provide a schedule showing the key decision milestones and other key points in time for SDI in the same format required of any other DoD research program engaged in advanced development to support a full scale development decision leading to an intial operational capability (IOC) of a weapon system. Provide a schedule encompassing both early and later deployment architectures.

Answer. SDIO, JCS, and the Services are now in the process of developing the documentation and decision documents (e.g., Justification for Major System New Start, Joint Operational Requirement and System Concept Paper) similar to other DoD research and acquisition programs. This will entail providing target dates for key decision milestones including the Full Scale Development Decision, Milestone II, Milestone III, and Initial Operational Capability (IOC) dates. These dates, planning factors, and programmatic detail will be presented to the Defense Acquisition Board (DAB) in mid-summer, and consequently will be available only after that time.

SDIO, over the last two years, has been evaluating several strategic defense concepts covering various phased deployment times. Among these different studies, deployment IOC's were estimated to begin to occur by the mid-1990's and other IOC's studies envisioning later deployment architectures project in the very late 1990's and even into the 2000 time period.

Question. Does SDI have a highly compartmented, classified program underway to develop detailed cost and other details about an early deployment system and architecture? Please provide for the record.

Answer. No.

QUESTION. Have SDI officials been approaching contractors to draw up plans and proposals for near-term deployment systems and components? If so, why is this being done before the President decides early deployment, and Congress agrees?

ANSWER. As you may be aware, the SDI Organization is staffed at a very austere level and performs the function of overall program management. Defense contractors and professional service organizations have been a key element in the progress which has been made in the research. In particular, these contractors have contributed to the definition of potential system architectures. As we continue to examine concrete, working hypotheses about the type of defensive options that may be available in the early to mid 1990s, contractors will no doubt continue to play a significant role. These analyses will contribute to a basis for an eventual fully informed decision on strategic defenses.

QUESTION. Under the reoriented SDI program, what level of risk exists (high, medium, low) -- that directed energy weapons will be able to replace the KEW-SBKKV when Soviet fast burn boosters are deployed to counter the early deployment weapons?

ANSWER. While the SDI research program has not been "reoriented," the approach to strategic defense known as phased deployment includes the consideration for deployment by the Soviets of fast burn boosters and other counter measures. As discussed in detail in the April 1987 SDI Report to the Congress, the first phase could include the space based kinetic kill interceptors, and a subsequent phase could include directed energy weapons or other systems appropriate to the counter measure. Regarding risk for directed energy weapons, clearly, the research is not complete. However, the program momentum and progress are increasing. Significant accomplishments are discussed in the April 1987 SDI Report to the Congress. The opportunities for continued progress depend largely on the level of funding for the overall SDI research program.

QUESTION: Has SDIO relaxed its requirements or proposals to contractors regarding development of a space-based kinetic kill vehicle and ERIS defense system, including all sensors, with the capability to attack Soviet weapons in the mid-course phase of trajectory? Would development of such a more capable system (including sensors) able to intercept in the mid-course, take longer than development of a system only capable to boost-phase intercept? Did SDIO reduce its requirements/proposals to contractors in this way to permit earlier deployment of a SBKKV and ERIS defense system?

ANSWER: No. SDIO did not change the SBKKV and ERIS requirements for mid-course attack capability. The SBKKV interceptor maintains [deleted] seeker for mid-course [deleted] [deleted] and the platform fire control sensors will be utilized in mid-course RV engagements. The contractors were told to emphasize boost/post-boost capability in the development of their concepts for SBKKV because of the overlap in mid-course coverage with the ERIS interceptor. [Deleted] [deleted]. In brief, the SBKKV system will maintain a capability to engage all targets (boost, post-boost, ASAT and RV's). Analysis will continue to optimize the mix of space and ground interceptors (and external sensors) required in mid-course.

QUESTION: Considering the SDIO's reduction in planned funding for the Space Surveillance and Tracking System (SSTS), will the SDI Program be able to develop a sensor capable of discrimination, tracking, and acquisition of Soviet re-entry vehicles with enough resolution to distinguish them from decoys in sufficient time to

support an early deployment SDI system? Why or why not? How much has the SSTS program slipped, due to budget reduction, from the plan presented to Congress in the FY 87 budget?

ANSWER: The answer to this question is highly dependent on both the threat posed (versus the timeframe) and what will be the preferred architecture (e.g. sensor concept) in that timeframe. We are now pursuing an aggressive development effort which will move the SSTS Program into concept development and component type testing beginning this summer. The current schedule will culminate in a demonstration/validation flight of an SSTS satellite in the early to mid 1990's. This experiment will demonstrate the capability to acquire, track, and "discriminate" to certain degree. As a result of the budget reduction the SSTS Program has slipped 1 to 2 years.

Question. How much is the effectiveness of a SBKKV/ERIS defense system degraded in the mid-course phase of the trajectory if it does not have the capability for interactive discrimination?

Answer. The effectiveness of the SBKKV/ERIS in midcourse is clearly a function of the postulated Soviet threat. Interactive discrimination will be needed only if the Soviets succeed in developing and deploying large numbers of very sophisticated decoys. Passive sensor techniques are available today to provide good capability [deleted]. Several active techniques (radar and lasers) show great promise and are currently being evaluated in our research program. The right mix of discrimination techniques to be deployed for maximum effectiveness depends on the deployment timeline and numbers of sensors/weapon assets.

QUESTION: Has SDIO reduced funding or slipped schedules for research on sensors, weapons, and battle management capabilities necessary for mid-course defenses. If so, by how much in each case - compared to the FY 87 budget plan - and were these actions taken to protect funding for research on early deployment boost phase defenses.

ANSWER: There have been no funding cuts or schedule slips to protect research on early deployment boost phase defenses at the expense of sensors, weapons and battle management research supporting mid-course defenses. Furthermore, it is critical to note that the first phase of any deployment would consist of sensors, weapons and battle management for the boost and midcourse phases. It is not a question of deciding between boost phase defenses or midcourse phase defenses for the first phase of deployment. The first phase of any deployment must have both.

Let me also dispel the notion of early deployment. We have not nor are we contemplating any "early" deployment decision. We have, however, emphasized the idea of phased deployment - a concept that recognizes that a system of this size and complexity must be deployed in phases with each phase providing militarily useful capability and subsequent phases building upon the initial phases. Any decision to deploy would follow a full scale engineering development phase of the program - a phase that we do not anticipate entering until the early to mid 1990s. From our perspective that does not constitute early deployment and so, contrary to the idea that we have sacrificed one part of the program for another in support of early deployment, we have in fact continued to maintain a balanced program. Our budget submissions to the Congress continue to reflect a balanced program between technology development and technology validation on the one hand and between more mature and less mature technologies on the other, all of which must be pursued to support the concept of phased deployment. Frankly, the greatest danger to the program at this point is continued serve cuts by the Congress to our budget requests. As our technology validation efforts progress they require significant funding increases. Failure to achieve the funding levels requested will, in fact, force difficult choices - choices which can be misunderstood.

QUESTION: How many heavy lift launch vehicles would be needed, and with what annual launch rate, and at what total costs (R&D, procurement, ground operations, etc.), to support early deployment of SDI in the 1993-94-95 period.

ANSWER: Over the first three year period of an SDI deployment, existing launch systems would be used to the maximum degree possible. To have an ALS capability in the mid-1990s, an interim ALS would be required that would use key existing technologies developed for the late 1990s system. While the cost of the ALS will not be known until after the concept definition studies are complete, a representative interim ALS based on STAS is costed. A major assumption made in answering your question is that SDIO will have the only requirement for the ALS during this timeframe and the ALS flight rate is the same as SDI requirements. This will not be the case since NASA and the AF will also be using it. Cost estimates for the interim ALS are $2.3B for DDTE, $90M/flight for procurement and operations, and $1.0B for launch facilities. To satisfy a representative first three years of an SDI deployment, 3-6-10 ALS launches might be required.

QUESTION. Does the statement of work issued by the SDIO as the guidance document for developing basic defensive architectures include direction to incorporate defenses for these architectures against a Soviet space-based BMD system with counterdefensive capabilities? Why or why not? What level of threat - high, moderate, low - does SDIO consider such Soviet space-based BMD systems to be against SDI space-based assets?

ANSWER. The SDI Organization is fully committed to researching strategic defense systems that will remain effective in the face of dedicated efforts to defeat them. Potential future strategic defense system architectures are presumed to operate in an environment with an advanced technology defense suppression threat. The possibility of a Soviet space based BMD system is considered. Major investments are made in technologies needed to enhance the survivability of space- and ground-based elements of any future ballistic missile defense system. Further, technologies within the SDI program are intentionally synergistic with other existing or planned U.S. systems for countering the growing threat to our military space assets.

A Soviet ground-based ASAT system is considered to be the more likely threat to U.S. space assets, at least for the near-term, than either a Soviet space-based BMD system or a Soviet Space-based ASAT system, for several reasons.

[Deleted.]

Summarizing, if the Soviets decide to deploy systems to threaten our space based assets in the nearer term they are much more likely to deploy ground based systems because these are improvements to present capabilities and build on existing systems. However, they are conducting research programs which could lead to space based systems further the future.

QUESTION. What major tests and experiments are planned for the SDI Program through FY 90; what information is it necessary to gain from these experiments to support early SDI deployment? Later deployment? What are the costs of each of these experiments as currently configured?

ANSWER. The April 1987 SDI Report to the Congress addresses the objectives, milestones and costs at the project level of detail for the research activities within each program element of the SDI Program. These data are contained in the "Descriptive Summary" sections of the report. Further, the same report provides, in the ABM Treaty compliance section, a description of each of the major experiments planned for the SDI Program.

QUESTION: Provide a detailed assessment of the validity, or lack thereof, of the cost and schedule estimates made by the George C. Marshall Institute. The Heritage Foundation, The Council on Economic Priorities, and the Blechman/Utgoff study for the particular BMD scenarios each considers.

ANSWER: SDIO has taken note of the BMD cost and schedule estimates contained in the George C. Marshall Institute, the Heritage Foundation, The Council on Economic Priorities and the Blechman/Utgoff studies. However, none of these studies provided detailed cost and schedule estimate assumptions, and schedule estimating databases. Hence a detailed assessment of these studies would be inconclusive. All of these reports

noted the uncertainty in their cost estimates. The Blechman/Utgoff study indicated that there was considerable variability in their cost estimates based on assumptions about learning curve rate and other factors. These studies, of necessity, incorporate assumptions regarding costs and the availability of technology which do not reflect the best available knowledge and projections. This information is being developed now as a result of SDIO-driven research (and related efforts) and is impacting the type of outcomes that these studies seek to project. SDIO is developing its cost analysis capabilities to incorporate this new research in order to provide the best cost data to support decision making.

Question. Has SDIO lowered the performance requirement of the SBKKV being considered for early deployment to exclude a key sensor device from initial versions of the SBKKV system, with the result that more Soviet warheads/launchers could pass through these defenses during the boost phase? If so, what percent degradation in effectiveness is caused by this exclusion of the sensor? Why is this degradation in effectiveness acceptable, and what has changed in the Soviet threat since this requirement originally was set which would justify this alteration in the requirement?

Answer. No. SDIO has not lowered the performance requirements of the SBKKV systems and has not excluded any sensor from any version of the SBKKV system. [Deleted]

[deleted]. The full complement of sensors required for a robust boost phase system have not been finalized. We expect to continue system analysis and conduct ground and flight experiments that will cover all the sensor options so that data will be available to support latter program decisions.

The number of warheads that can get through each of the SBKKV system engagement stages is a function of [deleted]

[deleted]. It would be difficult to generalize the effectiveness impact of the presence or absence of a particular sensor.

NATIONAL TEST BED

Question. What role does the SDI National Test Bed have in supporting any early deployment decision, and would it be prudent and necessary, or simply desirable to test the viability and effectiveness of any early deployment systems and architectures on the National Test Bed before any decision is made regarding early SDI deployment? Why or why not?

Answer. The National Test Bed (NTB) plays the same role regarding any potential early deployment decision that it would for any eventual deployment decision. The NTB program will provide a simulation environment that increases in scope, fidelity, and realism so that the total system can be examined over the full range of threat options. We believe that it is essential that potential SDI architectures be thoroughly examined in the NTB. A testing program that examines all aspects of an integrated SDI system is not possible. The testing program will provide the data for the validation of the NTB simulation environment. In addition, the NTB will provide the environment for testing pieces of the SDI system in a simulated system.

It would be desirable to have the NTB available for as long as possible before a decision simply because it is one very useful part of a risk reduction program no matter what SDI system configuration one is considering. The NTB is, however, complementary to other system test programs. The longer it is available the more confidence can be obtained in support of the decision process. I would say that slippage in the NTB program would impact an early deployment scenario more than a later deployment simply because there would be less time to apply the NTB to the problem.

Question: Has SDIO reduced or eliminated an original requirement that SBKKV interceptors be able to defend against Soviet attack on the satellite battle stations on which they are deployed? If so, was this done to simplify the tasks required to develop the SBKKV system fast enough to permit early deployment? Has there been any reduction in the Soviet threat projected by the U.S. intelligence community to be posed against SDI systems between the time the original self-defense requirement was mandated, and when it reportedly was reduced or eliminated, which would justify any reduction or elimination of this requirement? Provide details for the record.

Answer: No. The SDIO has not reduced or eliminated an original requirement that SBKKV interceptors be able to defend themselves. Both the past and the proposed system studies evaluate a wide range of potential approaches for defending SBKKV platforms and interceptors. These approaches include proliferation, shoot back, maneuvers, armour, electronic countermeasures, stealth and mutual defense. The optimum combination of these approaches has not been selected.

QUESTION: Has SDIO directed any of its contractors to concentrate on developing early deployment systems not capable by themselves of countering Soviet countermeasures to them? Has SDIO directed any of its early deployment-oriented contractors to develop systems required to be effective for fewer years before becoming obsolete against the Soviet threat than was the requirement at the time the FY87 budget was submitted last January? If so, by how many years has this requirement been reduced, what is the requirement now, and what reductions in the Soviet threat or other events have occurred since January, 1986, which would justify this reduction in effective operational life of early deployment systems?

ANSWER: It is not necessary that each component of a system be capable of negating all potential countermeasures directed at the component level but only that the system negate the effects of those countermeasures and that more advanced components be ready for deployment before earlier Soviet countermeasures can have a significant impact on defense system capability. It is not possible to establish exactly how fast the Soviets could respond to a given SDI technology. By and large the time to do so would be fairly long since

they must freeze their technology and go through field testing much like any other military system.

Question. Please list specifically the management, discretionary and other reserve amounts included in the FY 88 and FY 89 budget requests for the Director of SDIO and for each of the Program Managers of the 6 major programs in the overall SDI program: KEW, DEW, SLKT, SATKA, Systems Concepts and Battle Management, and Innovative Science and Technology.

Answer. In general, the SDIO does not maintain a management reserve. SDIO maintains a constant review of programs currently being executed to insure maximum return on the research dollar. Efforts that incur a contracting, administrative or technical deviation from the planned effort are identified. If savings in the current year are confirmed, then the resources can be used for alternate research efforts, within the scope justified to the Congress. Alternate approaches to perform technology development and technology validation often become apparent during the budget execution process.

In planning a research activity, more than one feasible approach may be available. The different approaches can generally be differentiated based upon risk, with cost increasing with risk. The FY88 budget has $2.8 million in Directed Energy identified as reserves. As the results from currently appropriated years become available , decisions are made which determine the approaches to be undertaken. Should the higher risk, higher payoff approach be pursued then the reserves will be consumed in research activities. Should the lower risk, lower cost approach be selected then those funds identified as reserves would be used to pursue other research activities within the bounds of Congressional justification.

Question. What project efforts have been reduced in either scope or level of capability from what was previously planned. Please address both those that have changed as a result of budget reductions and those that have changed as a result of technology findings. Describe the changes, why they were made, and the risks/tradeoffs involved. Please do the same for project level efforts that have increased in scope or level of capability.

Answer. Large budget reductions from the FY 1985 and FY 1986 requested levels caused a reduction in the number of promising technologies being pursued in parallel and increased the difficulty of realizing adequate solutions to specific technical issues. Further reductions made in FY 1987 have placed SDIO in a position where simply scaling back alternatives is no longer viable. We are faced with either delaying the time when defenses could be deployed, if a decision is made to do so, or eliminating some technology efforts, thereby reducing the number of defense options that can support a decision.

The progress of some portions of the SDI Program has been slowed approximately one to two years. The SDIO has slowed its rate of progress on some technologies required to hedge against Soviet countermeasures. The SDIO is still pursuing a balanced program, in which both technology development and technology validation efforts receive equal emphasis. However, the SDIO will not be able to maintain this essential balance if the trend of relatively large reductions from SDI budget requests continues.

The SDIO has focused on the technologies that could sustain performance to increasing levels of defense. Some technology candidates, however, have been either reduced or eliminated. The SDIO has retained pursuit of innovation at a smaller rate of investment. There are changes, some of which are irreversible, that have increased the schedule when effective defenses might be deployed and limited the available technical options. Additionally, by eliminating alternatives, including higher risk/higher payoff options, the risk of not achieving the SDIO goals has increased.

The SDIO is reducing some programs. For example, the SATKA program for FY 1987 included the Boost Surveillance and Tracking System to support the boost phase defense tier and the Satellite Surveillance and Tracking System for the midcourse defense tier. Reductions to the FY 1987 budget request caused a choice to be made between the two systems. The BSTS was protected because it supports high leverage boost phase intercept and the system is relatively mature. The same type of decision was made in the kinetic energy research program where validation work on electromagnetic launchers was cut back to support validation of the mature chemically propelled kinetic kill vehicles.

The impact of the reduction by project was as follows:

SATKA

Radar Discrimination & Data	PBV data collection terminated X & S band data analysis reduced
Optical Discrimination & Data	One Queen Match Flight cancelled
Radar Technology	Large radar array component development only
Laser Technology	Airborne ladar demo delayed 2 years
IR Sensor Technology	SWIR focal planes eliminated, Delay LWIR focal planes 1 year

Boost Surveillance and Tracking

BSTS contract award delayed until 2nd quarter FY87

Space Surveillance and Tracking

STEP experiment cancelled

Airborne Optical Surveillance

AOS concept definition delayed

Terminal Imaging Radar

TIR program delayed

Interactive Discrimination

NPB concept only

Signal Processing Technology

GAAS manufacturing capabilities delayed

DEW

Technology Integrated Experiments

Uplink experiment delayed one year, Phase II NPB initiation delayed six months, Pathfinder delayed & redirected to ELV, shuttle integration reduced from 2 to 1

Technology Base Development

Emerld experiment placed on hold, space relay mirror deleted, ground test accelerator delayed, CW tests delayed, NDEW ATP terminated, delays integration with DoE efforts

Concept Formulation & Technology Development Planning

Decreases early option support, NPB concepts cut back

Support Programs

Laser Target characterizations delayed 2 years

KEW

SBKKV Systems

Major program restructure
Test Flight delayed
Delays SBKKV Technology Development for 1990s decision

Exo KKV Systems	Braduskill interceptor terminated, Delays some test objectives one year, major delay in technology development
Endo KKV Systems	Major delays in technology development
Mini Projectiles	Trailblazer terminated, minuscule EML technology effort, restructure low endo to LEAP program
Test and Evaluation	One STM science package deleted, delays range improvements, restructure HWIL and simulation program, targets underfunded

SYSTEMS

Systems Architecture	Restructure Architecture studies, reduction in program planning and threat analysis, reduced service support to address architecture issues/tradeoffs
Systems Engineering	Delay industrial base analysis and cost modeling, no funding to support systems engineering requirements effort, system integration/NSITE minimally funded, reduce cost imposition effort
National Test Bed	Reduced number of sites(NODES), reduced support for FY88 validation efforts
BM/C3 Technology	Constrain and focus based on BM/C3 architecture findings, constrain/cancel existing contracts, hardware reductions
BM/C3 Experiments	Constrain validation efforts, rescope FY88 validation, reduce BM/C3 architecture efforts

SLKT

Systems Survivability	Limited nuclear hardening, no microwave hardening technologies, no NPB hardening technologies
Lethality and Target Hardening	Limited support to X-ray laser program, interactive discrimination, HEDI/ERIS No Prometheus support, feasibility study only for salvage fuzing
Power and Power Conditioning	Descope nuclear MMW, SP-100 IOC post 2000, no EML technology development
Space Transportation and Support	Minimal technology investment for 1990s, increase uncertainty in technology investment area
Materials and Structures	Reduced support to HEDI and ERIS technology

* * *

QUESTION. Assuming Congress and the Administration would like to proceed with full-scale development decisions in the early 1990s, what specific information will not be available (or will be available at significantly lower levels of confidence) than was planned prior to the fiscal 1986 and 1987 budget reductions. Would satisfactory information about x-ray laser capability as an offensive countermeasure be available?

ANSWER. A specific answer to that question would involve a good deal of conjecture. Previous year budget reductions were taken by eliminating certain parallel paths of research from the SDI Program. We stopped those paths which appeared to be least productive, but we may have given up, unknowingly, an opportunity for great success. Other research activities were delayed by the budget reductions, and, clearly, those delays result in less substantive information being available at any point in time. Thus, as decisions are made in the overall research program, those decisions are made with less information than could have been available with the requested budget.

* * *

QUESTION: Please provide a graph showing the expected capability of the initial (Kinetic-Kill Based) 3-layer Architecture being discussed against the baseline and reactive Soviet threats. What timeline assumptions underlie the results? Do these results assume a "maxi-

mum" offensive effort on the part of the Soviets? If not, how would such an assumption change the results in both degree and in timing.
ANSWER: There are a number of multi-tier Kinetic-Kill Based Architecture concepts which SDIO is currently examining. Each concept has unique capabilities and timelines which are effective against a range of Soviet attacks in different timeframes. It is for this reason that a single graph on the capabilities of a Kinetic-Kill Base Architecture is not available. At the time that a specific architecture concept is selected, the system capabilities, trade-offs and performance envelopes will be provided. An assessment of the threat will also be provided.

Question. Each year SDIO provides briefings illustrating, at project level detail, the impact of Congressionally-imposed budget reductions as well as increases in project efforts. Please consolidate this information by describing year-by-year for the fiscal years 1986-1988, how SDIO allocated the budget reductions imposed by Congress. Describe reductions and delays in projects as well as increases. Elaborate on projects that show changes in trends from one year to the next.

Answer. Large budget reductions from the FY1985 and FY1986 requested levels caused a reduction in the number of promising technologies being pursued in parallel and increased the difficulty of realizing adequate solutions to specific technical issues. Further reductions made in FY1987 have SDIO in a position where simply scaling back alternatives is no longer viable. We are faced with either delaying the time when defenses could be deployed, if a decision is made to do so, or eliminating some technology efforts, thereby reducing the number of defense options that can support a decision.

The progress of some portions of the SDI Program has been slowed approximately one to two years. The SDIO has slowed its rate of progress on some technologies needed to hedge against potential Soviet countermeasures. In light of the potential Soviet threat, the SDIO is extremely concerned about this slowdown. To date, despite reductions in the budget requests, the SDIO is still pursuing a balanced program, in which both technology development and technology validation efforts receive equal emphasis. However, the SDIO will not be able to maintain this essential balance if the trend of relatively large cuts from SDI budget requests continues.

The SDIO has focused on the technologies that could be used to sustain performance growth to increasing levels of defense. However, effort on some technology candidates has been either reduced or eliminated. The SDIO has retained pursuit of innovation, but at a smaller investment rate. There are changes, some of which may be irreversible, that have lengthened the time when effective defenses might be deployable and limited the technical options that will be available.

By eliminating alternatives, perhaps higher-risk/higher-payoff alternatives, the risk of not achieving SDIOs goals has increased.

The SDIO is reducing some of its programs. For example, the SATKA program for FY87 included the Boost Surveillance and Tracking System (BSTS) to support the boost phase defense tier and the Satellite Surveillance and Tracking System for the midcourse defense tier. Reductions to the FY1987 budget request caused a choice to be made between the two systems. The BSTS was protected because it supports the high leverage boost phase intercept and the system is relatively mature. The same type of decision was made in the kinetic energy research program where validation work on electromagnetic launchers was cut back to support the technology validation of more mature chemically propelled kinetic kill vehicles.

Even though this strategy continues to be the best of available alternatives, budget reductions have seriously reduced the ability to reach the programs ultimate goal. The impacts by program element and project are as follows:

SATKA

($ in millions)

FY86 REQUEST	FY86 APPN	FY87 REQUEST	FY87 APPN	FY88 REQUEST

Radar Discrim & Data Collect

74	18	22	13	23

FY86 impact: Cancel all major experiments except Cobra Judy, Cobra Judy scope reduced.

FY87 impact: PBV data collection terminated, X & S band data analysis reduced.

Optical Discrim & Data Collect

199	116	127	91	87

FY86 impact: Queen Match and OAMP delayed one year. No optical data on Soviet targets until 89/90.

FY87 impact: One Queen Match flight cancelled

Imaging Radar Technology

46	27	50	26	32

FY86 impact: Reduced scope, cancel major efforts, eliminate radar as sensor.

FY87 impact: large radar array component development only

Laser Radar Technology

127 77 116 96 148

FY86 impact: delayed efforts one year, eliminated competing approaches.

FY87 impact: airborne ladar demo delayed two years

IR Sensor Technology

151 82 105 79 94

FY86 impact: project delayed two years, parallel technology eliminated, manufacturing technology & productibility delayed.

FY87 impact: SWIR focal planes eliminated, delay LWIR focal planes one year.

Boost Surveill & Tracking Sys

131 73 165 130 256

FY86 impact: delay experimental efforts including development of "early warning" satellite one year. Conduct only studies.

FY87 impact: BSTS contract award delayed until 2nd quarter FY87

Space Surveill & Tracking Sys

136 83 122 48 192

FY86 impact: cancel comprehensive and limited flight experiment option. Technology program delayed.

FY87 impact: STEP experiment cancelled. Mission requirement work extended.

Airborne Optical Surveil System

192 135 100 99 104

FY86 impact: AOS delayed one year, advanced efforts cancelled, high altitude discrimination capability eliminated.

FY87 impact: AOS concept definition delayed.

Terminal Imaging Radar

74 32 94 26 117

FY86 impact: program delayed one year, only studies continued.

FY87 impact: TIR program delayed.

Interactive Discrimination

0 8 25 4 32

FY87 impact: NPB concept only.

Signal Processing Technology

0 109 158 106 135

FY86 impact: down select and eliminate parallel technologies with one year project delay

FY87 impact: GAAS manufacturing capabilities delayed.

SATKA Integration & Support

250 97 178 149 248

FY86 impact: Common technology & architecture development delayed. Parallel approaches eliminated.

FY87 impact: SATKA integration efforts delayed.

Space-Based Imaging

6 0 0 0 0

FY86 impact: down scoped to Interactive discrimination effort.

Countermeasures

0 0 0 1 0

FY87 impact: Countermeasures effort consolidated in SLKT with FY88 budget submission.

Innovative Science & Technology

0 0 0 42 25

FY87 impacts: Separately identified in FY88 budget.

Shuttle Recovery

0 0 0 14 0

FY87 impacts: Project to offset impact of Challenger incident.

SATKA Totals

1386	857	1262	925	1493

DIRECTED ENERGY WEAPONS

($ in millions)

FY86 REQUEST	FY86 APPN	FY87 REQUEST	FY87 APPN	FY88 REQUEST

Space-Based Laser Concepts

372	0	0	0	0

FY86 impacts: Major program restructure. SBL High power integration cancelled. SBL system level validation program deleted. Studies defining potential SBL programs only. Laser development efforts reconfigured into Tech Base efforts.

Ground-Based Laser Concepts

431	0	0	0	0

FY86 impacts: Major program restructure. Ground based FEL upselected for early demonstration of BMD class laser beam control technology for boost phase intercept as a Technology Integrated Experiment. Other concepts maintained as development efforts in Tech Base.

Space-Based Particle Beam Concepts

133	0	0	0	0

FY86 impacts: Major program restructure. Upselected for on orbit NPB discrimination Technology Integrated Experiment as a Technology Integrated Experiment.

Nuclear Driven Concepts

29	0	0	0	0

FY86 impacts: Major program restructure. NDEW efforts realigned as Tech Base development. All DoE NDEW research eliminated except x-ray laser.

Tech Base Development

0	437	407	340	341

FY86 impacts: Major program restructure. Severe cutbacks in SP & RP excimers, chemical lasers, RF linac fel technology and other laser research. Major portion of GBL relay mirror technology reduced.

FY87 impacts: Emerld experiment placed on hold, space relay mirror deleted, ground test accelerator delayed, CW tests delayed, NDEW ATP terminated, delays integration with DoE efforts.

Technology Integratation Experiments

0 310 1073 402 588

FY86 impacts: Major program restructure. Upselected GBL and NPB efforts realigned with validation efforts as Technology Integrated Experiments. Space ATP efforts eliminated except Pathfinder.

FY87 impacts: Uplink experiment delayed one year, Phase II NPB initiation delayed six months, Pathfinder delayed & redirected to ELV, shuttle integration reduced from 2 to 1.

Concept Formulation & Technical Development Planning

0 24 30 27 32

FY86 impacts: Major program restructure realigned concept study efforts from basing concept efforts. SBL system studies deleted, major cut in GBL concept studies. Excimer studies eliminated.

FY87 impacts: Decreases early option support, NPB concepts cut back

Technology Support Programs

0 73 105 62 115

FY86 impacts: Major program restructure realigned support programs from basing concepts. HELSTF, MIRACL program cut.

FY87 impacts: Laser target characterizations delayed 2 years.

Innovative Science and Technology

0 0 0 13 28

FY87 impacts: Separately identified with FY88 budget.

DEW Total

965 844 1615 844 1104

KINETIC ENERGY WEAPONS

($ in millions)

FY86 REQUEST	FY86 APPN	FY87 REQUEST	FY87 APPN	FY88 REQUEST

Endo Nonnuc Kill Tech

101	54	116	0	0

FY86 impact: Terminates advance seeker, fuze & window contracts. Slips validation 9-12 months. Limited allied defense.

FY87 impact: Reduced and realigned into Endo KKV systems. Major delays in technology development.

Exo NNK Tech

110	44	96	0	0

FY86 impact: Limited near term technology output & technical integration. Braduskill concept studies added.

FY87 impact: Braduskill interceptor terminated, major delay in technology development.

Subsystem Engineering & Analysis

12	0	0	0	0

FY86 impact: Reduced and realigned into validation efforts.

Hypervelocity Launcher Tech

69	54	104	0	0

FY86 impact: Railgun developments including GEDI, Trailblazer and power generation efforts stopped.

FY87 impact: Realigned into Miniprojectiles. Trailblazer terminated. Minuscule EML technology effort.

Novel Concepts

29	0	0	0	0

FY86 impact: Reduced and realigned into technology development efforts.

Endo NNK Test Bed

102	62	121	0	0

FY86 impact: Validation slips 9-12 months.

FY87 impact: Realigned into Endo KKV Systems. Major delays in technology development.

Exo NNK Test Bed

121	73	107	0	0

FY86 impact: Validation tests of critical ERIS components only. Delays flight schedule six months.

FY87 impact: Realigned into Exo KKV Systems. Braduskill interceptor terminated, Delays some test objectives.

Integrated Hypervelocity Launcher Test Bed

39	35	63	0	0

FY86 impact: No high energy tests facility. Impacted due to reduced technology development.

FY87 impact: Reduced and realigned into Miniprojectiles.

Space Based Kinetic Kill Vehicle Systems

147	99	156	127	303

FY86 impact: Delay in Brassboard developments. Rephase and rescope contractual design contracts. Delays down select and reduces brassboard competition by 25 percent. Eliminates guidance and control, fire control efforts. STM concept added.

FY87 impact: Major program restructure. Test flight delayed. Delays SBKKV technology development for 1990s decision.

Hardware in the Loop Simulation

130	19	32	0	0

FY86 impact: Simulation effort reduced to studies.

FY87 impact: Reduced and realigned into Test and Evaluation effort.

KMR Instrumentation Dev and SDI Targets

0	11	45	0	0

FY86 impact: Support efforts realigned from validation efforts.

FY87 impact: Reduced and realigned into Test and Evaluation efforts.

Significant Technical Milestone

0 144 151 0 0

FY86 impact: Realigned from SBKKV efforts.

FY87 impact: Realigned into Test and Evaluation efforts.

Exo Atmospheric KKV Systems

0 0 0 108 221

FY87 impact: Exo Atmospheric KKV Technology and Test Bed consolidated. Braduskill interceptor terminated, delays some test objectives one year, major delay in technology development.

Endo Atmospheric KKV Systems

0 0 0 111 238

FY87 impact: Endo Atmospheric KKV Technology and Test Bed efforts consolidated. Major delays in technology development.

Mini-Projectiles

0 0 0 75 103

FY87 impact: Hypervelocity Technology and Launcher Development consolidated and reduced. Trailblazer terminated, minuscule EML technology effort, restructure low endo to LEAP program.

Test & Evaluation

0 0 0 252 109

FY87 impact: Realign KMR instrumentation, STM and Hardware in the Loop. One STM package deleted, delays range improvements, restructure HWIL and simulation program, targets underfunded.

Allied/Theater Defense

0 0 0 44 73

FY87 impact: Realigned from Endoatmospheric NNK Technology and identified in FY88 budget.

Innovative Science and Technology

0 0 0 13 28

FY87 impact: Realigned and identified in FY88 budget.

KEW Total

860	596	991	730	1075

SYSTEMS

($ in millions)

FY86 REQUEST	FY86 APPN	FY87 REQUEST	FY87 APPN	FY88 REQUEST

SDI Strategic Architecture

98	80	143	58	91

FY86 impact: Reduction in scope and delay of architectures/ systems analysis. Delays results required to set performance requirements program wide. Integration efforts delayed and forced to rely on assumptions. Systems Engineering, and Theater Architecture realigned into separate projects.

FY87 impact: Restructure architecture studies, reduction in program planning and threat analysis, reduced service support to address architecture issues/tradeoffs.

SDI Systems Engineering

0	0	0	20	39

FY87 impact: Realigned from Strategic Architecture. Delay industrial base analysis and cost modeling, no funding to support systems engineering requirements effort, system integration/NSITE minimally funded, reduced cost imposition effort.

Theater Architecture

0	0	0	40	38

FY87 impact: Realigned from Strategic Architectures. Bilateral (UK & Israel) and multinational competitive efforts minimally funded.

BM/C3 Technology

145	106	159	88	122

FY86 impact: Severe reduction and one year delay to BM/C3 development efforts. Validation efforts realigned to BM/C3 Experimental Systems and National Test Bed.

FY87 impact: Constrain and focus based on BM/C3 architecture findings, constrain/cancel existing contracts, hardware reductions.

BM/C3 Experimental Systems

0 23 84 81 173

FY86 impact: Validation efforts realigned from BM/C3 Technology.

FY87 impact: Constrain validation efforts, rescope FY88 validation, reduce BM/C3 architecture efforts.

National Test Bed

0 18 76 61 119

FY86 impact: Realigned from BM/C3 Technology. National Test Bed full implementation delayed by one and a half years.

FY87 impact: Reduced number of sites (NODES), reduced support for FY88 validation efforts.

Countermeasures

0 0 0 5 0

FY87 impact: Program consolidated within SLKT with FY88 budget submission.

Innovative Science and Technology

0 0 0 18 28

FY87 impact: Separately identified with FY88 budget.

Civil Applications

0 0 0 2 2

FY87 impact: Separately identified with FY88 budget.

Medical Free Electron Laser

0 0 0 14 15

FY87 impact: Separately identified with FY88 budget.

SYSTEMS Total

243 227 462 387 627

SURVIVABILITY, LETHALITY, AND KEY TECHNOLOGIES

($ in millions)

FY86 REQUEST	FY86 APPN	FY87 REQUEST	FY87 APPN	FY88 REQUEST

System Survivability

72	59	71	60	94

FY86 impact: Delay in countermeasure programs against neutral particle beam and microwave threats, ground based lasers and x-ray lasers. Unacceptable risks in survivability technical options.

FY87 impact: Limited nuclear hardening, no microwave hardening technologies, no NPB hardening technologies.

Lethality and Target Hardening

103	92	128	78	102

FY86 impact: Hardened booster tests at WSMR slip one year. X-ray laser missed data collection from near term test. Decision milestone on high power microwave slips one year.

FY87 impact: Limited support to x-ray laser program, interactive discrimination, HEDI/ERIS. No promethus support, feasibility study only for salvage fuzing.

Power and Power Conditioning

64	50	140	86	158

FY86 impact: Eliminates FY86 multimegawatt technology development, reduces program to paper studies of conceptual designs.

FY87 impact: Descope nuclear MMW, SP-100 IOC post 2000, no EML technology development.

Space Transportation and Support

19	21	67	37	434

FY86 impact: Significantly reduces technology investments in low cost transportation.

FY87 impact: Minimal technology investment for 1990s, increase uncertainty in technology investment area.

Materials and Structures

0	0	21	15	23

FY87 impact: Reduced support to HEDI and ERIS technology

Countermeasures

0	0	27	24	43

FY87 impact: Program consolidated within SLKT with FY88 budget submission.

Innovative Science and Technology

0	0	0	19	28

FY87 impact: Separately identified with FY88 budget.

HELSTF

0	0	0	19	18

FY87 impact: Separately identified with FY88 budget.

SLKT Totals

258	222	454	338	900

Q: Please provide an "apples to apples" comparison of Soviet and U.S. strategic defense activites -- estimating a total* "Soviet Strategic Defense Initiative" Budget for FY 88 including activities of the five major sub-programs of U.S. SDI, and providing qualitative comparison of which nation leads in the key scientific, technological and engineering areas embodied in the five sub-programs. (Estimate Soviet SDI budget by total, and for each of five U.S. SDI sub-programs).

A: [Deleted.]

Turning to a qualitative comparison, the U.S. leads in many of the technologies required to develop future BMD systems. Significant Soviet leads exist, however, in certain areas. Relative standings in each of five U.S. SDI sub-programs are summarized below:

1. Directed Energy - The overall level is about equal with each side leading in some of the key technologies. As to cost, the level of Soviet directed energy weapons research and development is consistent with a U.S. effort costing about $1 billion/year.

2. Kinetic Energy - The Soviets are known to be pursuing many of the same types of kinetic energy weapons technologies being developed by the U.S. [Deleted]

[deleted] it appears that the U.S. leads or is equal to the Soviets in most of the key component technologies.

3. Systems Analysis and Battle Management - Although the Soviets maintain battle management ABM radars and are constructing a network of large phased array radars, which are suitable for this role in a nationwide system, in the key computer and communication technologies in this area, the U.S. leads.

4. Surveillance, Acquisition, Tracking and Kill Assessment - The Soviets have a deployed multilayer network including radars and launch detection satellites. However, except for a Soviet advantage in optical discrimination, the U.S. is believed to lead in other key technologies in this area.

5. Support - In the key areas of space logistics and power conversion, the Soviets enjoy a clear lead.

QUESTIONS SUBMITTED BY SENATOR PROXMIRE

QUESTION. General Abrahamson, describe to this subcommittee how SDI is reorienting its program to pursue a near-term deployment of strategic defenses?

ANSWER. There has been an incorrect perception that the SDI Program has been reoriented to pursue a near-term deployment. The research program continues to be balanced program, addressing mature technology, emerging technology and innovative ideas, all of which may contribute to rendering the Soviet threat obsolete. There is an evolutionary approach to strategic defense, known as phased, or incremental, deployment. The concept of phased deployment is in recognition of the fact that no strategic defense system could be deployed all at once. However, it does not constitute any decision to deploy.

QUESTION. Last year you complained that when Congress cut your FY87 budget from $5.4 billion to $3.5 billion, it forced SDI to move back the date on when it could decide that strategic defenses are feasible and when SDI could be deployed. Now all of a sudden, this year you and Secretary Weinberger say that you can decide early that strategic defenses are feasible and that you can deploy strategic defenses early. What's going on here? One day you say your deployment decision date is pushed back because of funding cuts. The next day you're saying that your deployment decision date can be pushed forward with the funding cuts.

ANSWER. The previous response clarifies the misunderstanding that the SDI Program has been reoriented to pursue a near-term deployment. My earlier remark regarding set-backs caused by funding cuts is valid. The research is funding limited. The technological progress that has been made over the past three years has advanced at an unexpectedly fast pace, and is still accelerating. However, progress of some portions of the program has been slowed approximately one to two years. In particular, progress has been slowed on some technologies possibly needed in the longer term to hedge against potential Soviet countermeasures.

QUESTION. General Abrahamson, for three years now I've been asking you what a Star Wars defense would cost the poor American taxpayer, and for three years you've been answering that you don't know. Yet all this time you've been dead certain that we can build Star Wars. Well, for the fourth year in a row, I'm going to ask you: How much will Star Wars cost the poor American taxpayer? Can you tell me how you can come before this subcommittee and be so dead certain that SDI is feasible, but so uncertain about what it will cost?

ANSWER. We have made some gross cost estimates for one version of an initial phase of a deployment.

An initial SDI capability might fall in the cost range of $40 to $60 billion (calculated in FY85 $) -- roughly equivalent to the life cycle costs of the proposed small ICBM force.

Cost research is being pursued hand-in-hand with technology research. A status report on SDI cost initiatives and analyses was provided to the Congress on May 12, 1987. We sincerely hope that report will improve understanding of the effort in the SDI Program toward identifying complete cost parameters .

Question. General Abrahamson, again this year you and Secretary Weinberger have been telling the press of tremendous breakthroughs in SDI research. But scientists in and out of SDI say there have been no tremendous breakthroughs -- certainly none that would lead to the conclusion that achieving the President's vision of strategic defenses is feasible. So Congress is getting two stories on what this program is accomplishing and I think it's causing a credibility gap for SDI. The best way to correct this credibility gap would be to set up an independent review board of scientists that would look at all the classified information and tell Congress exactly what progress has been made in the program. But SDI has always opposed having an independent review board. Why is that?

Answer. There has been considerable technical progress in the SDI program over the past year as should be expected from an investment of several billion dollars in over 2000 contracts. The question of what constitutes a "breakthrough" is of course in the mind of the beholder. If by breakthrough one means the need to discover a so-called "silver bullet" that will magically transform all of SDI technology into an unbeatable system then indeed such a breakthrough has not been found. However, such a feat is not needed. Let me list for your attention a few areas that to my way of thinking do represent significant technical achievements and that do carry with them the promise to provide the country with the technology for effective defense against ballistic missiles as the President had envisioned.

First, the Kinetic Energy office has funded the Draper Laboratory which developed a resonating fibre optic gyro that makes miniaturized inertial measurement units (IMU) of extremely high accuracy [deleted] possible for less than $4000 per unit. This is indeed a breakthrough and has impacts that far exceed its usefulness on ERIS and SBKKV's in making these systems technically viable and more cost effective. An IMU of this type can be directly integrated into tactical weapons systems at an affordable price; this has the potential of revolutionizing the capability of "smart" conventional defense systems. In fact having such inexpensive units should allow the private aviation sector to equip small aircraft and thus help to prevent some of the more hazardous civilian aviation problems that are in the news as of late.

Another area impacting SBKKV technology is the development of thrust control valves, for rocket divert maneuvers, that operate in less than 1 millisecond -- a factor of ten improvement in the state of the art and a key factor in establishing the viability of SBKKV technical feasibility.

In the area of directed energy research we have seen the operation of high brightness negative ion sources (for neutral particle beams) of weapons-capable quality and operational times of over 30 seconds. In addition a completely remote-controlled start-up, operation, and shut down of a NPB injector and extractor was demonstrated. This was an essential step in having a space based NPB discriminator available in the 1990's.

The SDI program has funded the commercial development of radio frequency power sources that weigh as little as .3 grams/watt. The applications for this technology far exceed the space-based SDI system needs.

Our sensors program has developed a major new radiation-hardened infrared detector technology, called impurity band conduction (IBC). This should all but lock in the technical viability of providing sensor systems to perform some SDI missions even in the presence of severe radiation environments.

There are many other technical advances that could be added such as diamond coatings for optics, and the Sol-gel low temperature glass formation technology. However, I believe one can clearly see that not only has there been clear "measured" progress made in the scientific, engineering, and systems integration areas but that major accomplishments, of fundamental importance to establishing the technical feasibility of SDI, have also been produced.

The SDI program continues to be reviewed within the Administration by groups that do not have major vested interest in SDI, such groups as the Defense Science Board, the White House Science Council, and the Defense Acquisition Board, not to mention the periodic updates to the Joint Chiefs of Staff. Many of the members of these groups appear before Congress regularly. The scientific integrity of these people is beyond reproach and I am sure they communicate to Congress very clearly the problems as well as progress, in the SDI program. I do not, at this time, see a need for as yet another "outside" review of the program. I am, of course, always available to brief Congress on the program to whatever level of detail it is felt necessary.

Question. You want to set up the SDI Institute but that would be under your control. You have an advisory board but that's made up of SDI supporters. But you've resisted having an outside independent board reviewing your program. Wouldn't such a board solve the credibility problem this program faces?

Answer. I refer the Congress to my answer to the previous question on SDI progress to address the question of "outside" review. I would, however, like to take the opportunity to remind Congress of the present very real need to move forward with the establishment of the SDI Institute.

I am prepared to move as quickly as Congress will allow to bring about this FFRDC and thus provide to SDI, and through SDI to Congress, the best possible analysis of the technical and systems data base that will be necessary for an Administration and Congress to make informed decisions on SDI and its value in helping to better assure the security of not only the U.S., but also its Allies.

As you know, the GAO has reported that such an FFRDC is reasonable and sound. The Secretary of Defense and I have responded to all reporting requirements to Congress on this SDII issue. I would urge Congress to move with some dispatch in providing appropriate language to allow SDI to establish this entity soon.

QUESTION. General Abrahamson, in your 1985 Report to Congress you said that the SDI Program could operate within the strict -- or rather, the legal -- interpretation of the ABM Treaty until the early 1990's

when a developmental decision would be made. You said the same thing in your 1986 Report to Congress. Now we hear all this talk from SDI and the Department of Defense that it just has to test under the broad interpretation of the ABM Treaty before the early 1990's.

Isn't it a fact that before the early 1990's, SDI doesn't really need to conduct ant tests under the broad interpretation of the ABM Treaty? Isn't it a fact that politics, not the pace of SDI technology, is driving this push in the Administration to go to the broad interpretation of the ABM Treaty? Isn't it a fact that there have been no tremendous breakthroughs in SDI research since 1986 and no sudden threat from the Soviets since 1986 that would compel us to got to the broad interpretation of the Treaty?

ANSWER. The SDI research can proceed within the restrictive interpretation of the ABM Treaty. However, remaining within the restrictive interpretation of the Treaty will result in significantly greater cost, a longer period of research and less confidence in results than under the broad interpretation. A detailed DoD report on this subject, in response to Section 217 of the fiscal year Defense Authorization legislation, has been provided to the Congress. In October 1985, President Reagan concluded -- on the basis of an extensive review of the ABM Treaty and associated negotiating record -- that a broader interpretation of our authority under that treaty was fully justified. However, at the same time, he decided that it was not then necessary to restructure the SDI Program so as to make full use of the broader interpretation. Conditions have changed significantly since the President's October 1985 decision. Our technical understanding of the feasibility of advanced defensive options is growing rapidly. The costs -- in terms of resources, time and technical uncertainty -- of continuing our more restrictive policy are growing correspondingly. Therefore, the President is considering the restructuring of the SDI program to take advantage of our rights under the ABM Treaty.

The differences between an SDI program which continues to be conducted under the restrictive interpretation of the Treaty, and a restructured program that we could pursue under the broad interpretation, are significant. The broad interpretation would permit us to delay by several years a decision on fundamentally altering the ABM Treaty regime until we have confidence that the technologies which we had developed would meet our criteria for deployment. To achieve an equal level of confidence in defense feasibility under the restrictive interpretation, the United States would be forced in the future to make a decision to alter fundamentally the Treaty regime simply to conduct the tests necessary to enter into full-scale engineering development. The broad interpretation would allow the program manager to design more realistic tests to inte-

grate weapons, sensors and battle management/command, control and communications. The broad interpretation would reduce costs significantly and allow for greater efficiency. We estimate that it would save two years in the research program and at least $3 billion in establishing the feasibility of an initial defense against ballistic missiles.

Question. In December, Robert Jastrow and the Marshall Institute published a report that they say was based on an "up-to-date data base" provided by SDI's program managers. The report claims that for a mere $121 billion we can deploy, beginning in 1994, 11,000 kinetic kill vehicle interceptors based in space and 13,000 ground-based interceptors. I've got four questions to ask you about this:

1. Is this report based on information that SDI supplied to the Marshall Institute?

2. Can we, in fact, deploy 11,000 space-based interceptor and 13,000 ground-based interceptors beginning in 1994 for only $121 billion?

3. Is the Marshall Institute report a trial balloon for the type of near-term deployment SDI has in mind?

Answer. Members of the Marshall Institute do have access to some information (both classified and unclassified) on SDIO programs. The SDIO has not made a detailed study of this institute's report. While system concepts are still being refined, and cost-estimating methods developed, SDIO estimates that an initial SDI capability might fall in the cost range of $40 to $60 billion (FY85 $). That estimate represents expenditures for a potential first phase of a strategic defense system consisting of boost-phase surveillance and tracking system (BSTS), exo-atmospheric reentry vehicle intercept system (ERIS), space-based kinetic energy interceptors, probe, and battle management/command, control and communications. The May 1987 report to the Congress on the status of SDI cost initiatives and analysis presents a full discussion of SDI's work in developing strategic defense cost estimates and reducing the costs of possible deployed systems. As the report indicates, the estimate of $40-60 billion is not a final one. Actual costs of initial defensive deployments will be subject to a range of factors, including the nature of the Soviet threat, the timing and structure of SDI testing, and the precise size and characteristics of initial defensive deployments. As the report also emphasizes, the SDI is pursuing a wide range of cost-saving new technologies, production methods and management techniques which will significantly reduce the costs of actual deployed systems. Taking account of all those factors, the estimate of $40-60 billion is reasonable.

It is important to qualify that cost estimate, however. As concept definition is further refined, cost estimates will be refined correspondingly. While the cited figure is valid on the date of this hearing, it may change in the future.

QUESTIONS SUBMITTED BY SENATOR HOLLINGS

QUESTION: Under the so-called narrow interpretation --or "deceptive" interpretation as I would call it--of the ABM Treaty, the opponents of SDI would restrict SDI to basically a lab test program. Can you describe what promising technology for defense of our strategic retaliatory forces would be stopped by this prohibition?

ANSWER: Under either interpretation (broad or restrictive) ABM systems based on other physical principles that include a device that can substitute for any one of the traditional ABM components cannot be deployed without agreement in accordance with the ABM Treaty. The restrictive interpretation goes even further, and holds that these devices can not even be developed or tested if they are mobile. Consequently, the restrictive interpretation prohibits developing space based components (space based sensors, interceptors, lasers, particle beams, etc.) and air based components (airborne optical sensors) as well as some ground based components that use space based mirrors to deflect the beam and for targeting). Thus, the restrictive interpretation greatly reduces the applicability of almost every advanced defense concept being examined by SDI.

The differences between an SDI program which continues to be conducted under the restrictive interpretation of the Treaty, and a restructured program that we could pursue under the broad interpretation, are significant. The broad interpretation would permit us to delay by several years a decision on fundamentally altering the ABM Treaty regime until we had full confidence that the technologies which we had developed would meet our criteria for deployment. To achieve an equal level of confidence in defense feasibility under the restrictive interpretation, the United States would be forced in the future to make a decision to alter fundamentally the Treaty regime simply to conduct the tests necessary to enter into full-scale engineering development. The broad interpretation would allow the program manager to design realistic tests to integrate weapons, sensors and battle management/command, control and communications. The broad interpretation would reduce costs significantly and allow for greater efficiency. We estimate that it would save two years in the research program and at least $3 billion in establishing the feasibility of an initial defense against ballistic missiles. The broad interpretation would allow the United States to retain the option to decide to deploy strategic defenses in the mid-1990s. Even under ideal conditions, the restrictive interpretation would delay deployment until the late 1990s.

Question: Are the Soviets currently in violation of any provision of the ABM Treaty? Are they suspected of being in violation of several provisions?

Answer: The large phased-array ballistic missile detection and tracking radar under construction near Krasnoyarsk in Siberia violates the ABM Treaty. The radar is not located on the periphery of the USSR and pointed outward, as the Treaty requires for early warning radars. It is some 750 kilometers from the nearest border (Mongolia), and is oriented not toward that border, but across approximately 4000 kilometers of Soviet territory to the northeast.

The growing Soviet network of large phased-array radars (LPARs), of which the Krasnoyarsk radar is a part, is of particular concern when linked with other Soviet ABM efforts. These radars take years to construct and their existence could allow the Soviet Union to move quickly to deploy a nationwide ABM defense. The degree of redundancy being built into their LPAR network is not necessary for early warning. It is highly desirable, however, for ballistic missile defense.

During the 1970s, the Soviets developed components that could be integrated into an ABM system that would allow them to construct individual ABM sites in months rather than the years required for more traditional ABM systems. The development and testing of the components represent a potential violation of the ABM Treaty's prohibition against the development of a mobile landbased ABM system or components. By using such components along with the LPARs, the Soviets could strengthen the defenses of Moscow and defend targets in the western USSR and east of the Urals.

The Soviet Union has conducted tests that have involved air defense radars in ABM-related activities. The large number, and consistency over time, of incidents of concurrent operation of ABM and surface-to-air missile (SAM) components, plus Soviet failure to accommodate fully U.S. concerns, indicate the USSR probably has violated the Treaty's prohibition on testing SAM components in an ABM mode. Additionally, the SA-10 and SA-X12B/GIANT SAM systems may have the potential to intercept some types of strategic ballistic missiles. Both systems are expected to have widespread deployment.

Taken together, all of the USSR's ABM and ABM-related activities suggest that the Soviets may be preparing an ABM defense of their nation.

QUESTION: Can you describe the current Soviet ballistic missile defense capability regarding its: radar network; laser technology; missile interceptor capability, current or projected; space station experimentations; other technology.

ANSWER: The Soviet Union began to upgrade and expand its ballistic missile defense system in 1978 to the limits allowed by the 1972 ABM Treaty. It currently has 16 (originally 64) operational, reloadable above-ground Galos launchers. When completed, the 100 launchers will provide a two-layer defense composed of modified Galosh interceptors designed to engage targets outside of atmosphere, high-acceleration Gazelle interceptors designed to engage targets within the atmosphere, and a new large phased-array radar at Pushkino designed to control ABM engagements. The new system could be fully operational in the late 1980s.

The Soviet system for detection and tracking of ballistic missile attacks consists of a launch detection satellite network, two over-the-horizon radars directed at U.S. ICBM fields, and two types of large ballistic missile detection and tracking radars. The current launch detection satellite network and the two over-the-horizon radars can provide about 30 minutes warning of any U.S. ICBM launch. Eleven of the first type of large ballistic missile detection and tracking radars (Hen House network) are operational and on the periphery of the USSR. The radars can distinguish the size of an attack, confirm the warning from the satellite network and over-the-horizon systems, and provide target tracking data in support of antiballistic missile forces. Nine of the second type are either operational or under construction. These radars provide significantly improved target-tracking and - handling capabilities and add a redundancy in coverage over existing Hen House network. The new large phased-array radar near Krasnoyarsk in Siberia will close the final gap in Soviet ballistic missile early warning coverage. The entire network could become fully operational in the mid-1990s.

The Krasnoyarsk radar violates the ABM Treaty by virture of its location and orientation. The growing network of large phased-array radars, of which the Krasnoyarsk radar is a part, is of particular concern when linked with other Soviet ABM efforts. These radars take years to construct and their existence could allow the Soviet Union to move quickly to deploy a nationwide ABM defense. The degree of redundancy being build into the Soviet LPAR network is not necessary for early warning. It is highly desirable, however, for ballistic missile defense.

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Taken together, all of the Soviet ABM and ABM-related activities indicate a significant commitment to enhancing the strategic defenses of the USSR and suggest that the Soviets may be preparing an ABM defense of their nation.

In the late 1960s, the USSR initiated a substantial research program into advanced technologies applicable to ballistic missile defense systems. This effort covers many of the same technologies currently being explored in the U.S. SDI but involves a much greater investment of plant space, capital and manpower. For example, the USSR's laser program is considerably larger than U.S. efforts and involves over 10,000 scientist and engineers as well as more than a half-dozen major research and development facilities and test ranges. The USSR already had ground-based lasers that have some capability to attack U.S. satellites and could have a prototype space-based antisatellite laser weapon by the end of the decade. Additionally, the Soviets could have prototypes for ground-based lasers for defense against ballistic missile by the late 1980s and could begin testing components for a large-scale deployment system in the early 1900s. If technological developments prove successful, they probably could deploy a ground-based laser system for ballistic missiles defense in the late 1990s or after the year 2000, and a space-based system after the year 2000.

Since the late 1960s, the Soviets have been exploring the feasibility of using particle beams for a space-based weapon system. Much of the U.S. understanding of how particle beams could be made into practical weapons is based on published Soviet research conducted in the late 1960s and early 1970s. The USSR may be able to test a prototype space-based particle beam weapon intended to disrupt the electronics of satellites in the 1990s. An operational system designed to destroy satellites could follow later, and application of a particle beam weapon capable of destroying missile boosters or warheads would require several additional years of research and development.

The Soviet Union has also conducted research applicable to radio frequency weapons that would have the potential to interfere with or destroy critical electronic components of ballistic missile warheads. The Soviets could test in the 1990s a ground-base radio frequency weapon capable of damaging satellites.

The Soviets also have research programs underway on kinetic energy weapons, which use the high-speed collision of a small object with the target as the kill mechanism. Long-range, space-based kinetic energy weapons probably could not be developed until at least the mid-1990s. However, the Soviets could deploy in the near term a short-range, space-based system for space station defense or for close-in attack by a maneuvering satellite.

The Soviets have spent approximately $80 billion over the past ten years on their military space programs. The operate about 50 types of space systems for military and civilian uses; these include manned and man-associated spacecraft; space stations; reconnaissance vehicles; launch-detection satellites; and navigational, meteorological and communication systems. The USSR conducts approximately 100 space launches annually. Indeed, the success of the Soviet space program is due largely to its versatile and reliable inventory of space launch vehicles and to its space launch and support facilities.

QUESTION. If the U.S. stuck to a "narrow" interpretation of the ABM Treaty, would we be unilaterally complying with it in face of the Soviet position supporting research and testing of future ABM technology during the negotiation of the Treaty?

ANSWER. Yes. By continuing to adhere to the restrictive interpretation, the U.S. is following a self-imposed interpretation that is more restrictive than called for by the Treaty, and whose limitations the USSR explicitly refused to accept during the negotiation of the Treaty.

Question. Can you describe the damage done to the SDI program by the large cut in the request for FY87 --in terms of technical performance and schedule?

Answer. While the detail has been provided in resposes to earlier questions, in general, the large cut had a devasting impact on progress in the program. Previously planned expansions in critical validation efforts had to be postponed and technology development was reduced. The $3.2 billion appropriated permits only limited technology development for the entire multilayered defense and responsive threat. As a result, overall system performance risk has increased, technical validation schedules for some systems were seriously affected, e.g. SSTS, BSTS, TIR, NPB, EML, etc., and midcourse surveillance and discrimination for the responsive threat has been delayed.

QUESTION: How near to a nationwide defense capability are the Soviets?

ANSWER: The Soviet Union began to upgrade and expand its ballistic missile defense system in 1978 to the limits allowed by the 1972 ABM Treaty. It currently has 16 (originally 64) operational, reloadable aboveground Galos launchers. When completed, the 100 launchers will provide a two-layer defense composed of modified Galosh interceptors designed to engage targets outside of atmosphere, high-acceleration Gazelle interceptors designed to engage targets within the atmosphere, and a new large phased-array radar at Pushkino designed to control ABM engagements. The new system could be fully operational in the late 1980s.
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During the 1970s, the Soviets developed components that could be integrated into an ABM system that would allow them to construct individual ABM sites in months rather than the years required for more traditional ABM systems. The development and testing of the components represent a potential violation of the ABM Treaty's prohibition against the development of a mobile land-based ABM system or components. The Soviets probably have also violated the ABM Treaty's prohibition on testing surface-to-air missile (SAM) components in an ABM mode. In addition, the SA-10, and SA-X-12B SAM systems may have the potential to intercept some types of strategic ballistic missiles; both systems are expected to be widely deployed.

Taken together, all of the Soviet ABM and ABM-related activities indicate a significant commitment to enhancing the strategic defenses of the USSR and suggest that the Soviets may be preparing an ABM defense of their nation.

QUESTION. If we had a deployed SDI capability -- with the achievable layered technology by 1995 -- what increase in the survivability of the MX/Minuteman III force can we expect? Provide the current survivable rate plus that with the SDI program.

ANSWER. Development and deployment of initial phases of an evolutionary strategic defense system would perform a military useful function that contributes an increase in our security commensurate with the commitment of resources involved. The architecture concepts which are likely to be available in the mid-1990's are not intended as point defense systems that would defend only ICBMs. The capability of those systems to intercept attacking ballistic missiles and reentry vehicles would clearly increase the survivability of bomber bases, submarine ports, command/control/communications facilities, ICBMs and other important military assets. Further, such deployments would also increase arms control leverage for balanced reductions in offensive weapons, and thus indirectly enhance survivability. Precise estimates of survivability depend on the circumstances, and is a topic considered best addressed in a full report of potential system capabilities. Such a report would necessarily accompany the rationale upon which a future recommendation for deployment would be based.

QUESTION. The projected cost of the small ICBM is $50 to $75 billion. What is your estimated cost for the acquisition of an SDI layered program between 1988 and 1993?

ANSWER. While system concepts are still being refined, and cost estimating methods still being developed, gross cost estimates have been made for one version of an initial phase of a deployment. An initial SDI capability might fall in the cost range of $40 to $60 billion, in FY85 dollars, which is roughly equivalent to the life cycle costs of the proposed small ICBM force. This estimate is an example and has been derived using current cost estimating capabilities, which are subject to various limitations and uncertainties. A status report of SDI cost initiatives and analyses was submitted to the Congress on May 12 and included a detailed discussion of this topic.

QUESTIONS SUBMITTED BY SENATOR JOHNSTON

QUESTION: When will the American Physical Association's study on Directed Energy be released? It has been in security review about six months now.

ANSWER: A report, evaluating the status of the science and technology of directed energy weapons, by the American Physical Society (APS) has been cleared it was published by APS on April 23, 1987.

QUESTIONS SUBMITTED BY SENATOR BYRD

Strategic Defense Initiative

Question. The budget requests for the Strategic Defense Initiative (excluding work funded through DOE) for FY 1988 and FY 1989 are $5.22 billion and $6.28 billion, respectively. The Administration also has requested $500 million to supplement the $3.21 billion appropriated by Congress for FY 1987. The Administration has stated that congressional restraint in funding the SDI will lead to a one-to-two-year delay in obtaining the technical knowledge needed for a development and deployment decision in the early 1990s. On the other hand, others have suggested that the decision to deploy should be made in this Congress. Such conflicting positions give rise to added confusion over SDI objectives and the extent of Soviet progress in this field, which must be clearly understood to arrive at proper funding levels.

Recently, officials at the Strategic Defense Initiative Office have characterized the mission of SDI as an attempt to devalue Soviet offensive ballistic missiles in the minds of Soviet military planners. Does this statement represent a change in the direction of the SDI program? If this stated mission is correct, what, in practical terms, does it mean for project funding? For the scope and timing of development and deployment proposals to Congress?

ANSWER. That statement does not represent any change in the direction of the SDI Program. The goals of defense deployments are: (1) Deny the Soviets confidence in the military effectiveness and political utility of a ballistic missile attack; (2) Secure significant military capability for the U.S. and its allies to deter aggression and support their mutual strategy in the event deterrence should fail; and (3) Secure a defense-dominated strategic environment in which the U.S. and its allies can deny to any aggressor the military utility of ballistic missile attack.

In the investigation of potential of advanced defensive systems, the U.S. seeks neither superiority nor unilateral advantage. Rather, if the promise of SDI technologies is proven, the destabilizing characteristics of the current strategic environment could be rectified. And, in the process, deterrence would be strengthened significantly and placed on a foundation made more stable by reducing the role of ballistic missile weapons and placing greater reliance on defenses that threaten no one.

The SDI Report to the Congress, April, 1987, includes a complete discussion of the goals of the SDI Program, the investment strategy, and the evolutionary approach to strategic defense known as phased deployment.

QUESTION: A good deal has been said lately about the amount of money that the Soviets are spending on strategic defense. However, the Soviet funding figures quoted by Secretary Weinberger appear to include much more than efforts actually comparable to our SDI. What can you tell us about Soviet intent and levels of effort related to advanced, multi-layered ballistic missile defense concepts?

ANSWER: Figures quoted by Secretary Weinbeger, -- that the U.S.S.R. has spent approximately $200 billion on strategic defense over the past 10 years -- are the Intelligence Community's dollar estimate of the total Soviet strategic defense program, which comprises interceptor aircraft, strategic SAMs, ballistic missile defenses, and warning and control systems -- some of which might be employed in an SDI mission. These above referenced figures, the Intelligence Community's dollar estimates, reflect investment and operating costs, but exclude RDT&E costs, which cannot be disaggregated by mission. Although we do not have specific estimates of overall Soviet spending on advanced technologies for ballistic missile defense, we do estimate that the Soviet laser program alone would cost us $1 billion per year.

QUESTIONS SUBMITTED BY SENATOR LEAHY

QUESTION: General Abrahamson, it seems logical that the more Soviet warheads are held down, the easier it should be to defend against a Soviet ballistic missile attack.

a. This suggests that SDI depends on Soviet restraint in offensive forces. That can come either through unilateral Soviet restraint--which I consider unlikely in the extreme--or through arms control. Would you agree arms control is indispensable for any SDI system?

ANSWER: Arms control agreements can play an important role on the nature of the SDI Program. The three specific standards, or basic requirements, of survivability, military effectiveness, and cost-effectiveness at the margin will in and of themselves assure the success of any future ballistic missile defense system. To determine the feasibility of the technological path to fulfill these requirements is the charter of the SDI Program. Rather than being an indispensable element of an SDI system, arms control, with more prudent and realistic arms reductions, will be an anticipated result from the Strategic Defense Initiative.

QUESTION: Would it make your job more difficult if the Soviets begin to increase substantially their MIRVed ICBM force, as they are now free to do since the President decided to scrap the 820 MIRVed ICBM sublimit in SALT II.

ANSWER: The requirements of military effectiveness and cost-effectiveness at the margin are two of the three primary standards upon which the SDI Program will judge its success. At this point in the program, it is less important to hypothecate minutely detailed Soviet threats. Rather, the SDI Program is working with (and has as part of its organization) highly competent representation of all the intelligence community to establish Soviet threat evolution both in a constrained or unconstrained environment. These qualitative judgements are the basis for future defense options. In either case, the evaluation of these options will be based upon the degree to which certain types of defensive systems, by their nature, encourage or discourage an adversary to overwhelm them with additional offensive capability. It would however clearly require some additional costs and increased object count does put additional burden on any defensive system.

QUESTION: I understand the Soviets are now at about 818 or 819 MIRVed ICBMs. If they do not observe the 820 ceiling, my information is that they can increase their ICBM warhead level by 2000-3000 within 3 years, and by over 6,000 in about 6 years. This is without any special effort. With an intensive effort, sparked for example by fear of early deployment of an SDI system such as the Space-Based Kinetic Kill Vehicle, they could do far more than this.

Would your job be easier if the Soviets did not expand their MIRVed ICBM force like this? If the Soviets continued to show restraint until a new strategic arms agreement were concluded which actually reduced their ballistic missile warheads, would that be beneficial to your planning--or would it make no difference.

ANSWER: Planning within the SDI Program must take into account Soviet non-restraint as well as restraint in their ballistic missile force. To do otherwise would not be prudent. The tangible and visible results of such an approach will not only determine the feasibility of advanced defenses but also have the effect of deterring a strong offensive Soviet response and, thereby, enhance stability.

Clearly increased target sets will not make the SDI task easier. However, it would probably not be cost effective for the Soviets to come forward with this type of response given the numeric devaluation that occurs when defenses are introduced. It is, in fact, this devaluation of offensive missiles in the minds of the Soviet offensive mission planners that produces the deterrence that continues to be the most important mission for any SDI system.

QUESTION. General, as I compare funding increases in your FY88 and FY89 requests over the levels approved for FY87, it seems to me the big jumps are going into technologies for early deployment of SDI. For example, the big gainers seem to be in the Space-Based Kinetic Kill Vehicle, the Exoatmospheric Kinetic Kill Vehicle and the Heavy Lift Space Vehicle programs.

Is it correct to conclude that a decision has been made to emphasize early deployment and to deemphasize the futuristic technologies and programs aimed at the original Star Wars idea of a nationwide population defense?

ANSWER. From the very beginning, the SDI Organization has maintained the same goal--to conduct a vigorous research and technology development program that would help to eliminate the threat of ballistic missiles and provide increased U.S. and allied security. The basic investment strategy has three main thrusts: first, to bring mature technologies to the point that if a decision were made to proceed, the job of realizing the individual systems concepts would be largely one of engineering; second, to pursue the development of emerging technologies that have potential for major improvements in defense effectiveness; third, to invest in innovative ideas that hold the promise of great success. The challenge is to plan a program accordingly, prepare a budget request, and follow-thru with the funds appropriated. The substantial reductions in the past two budget years have made the implementation extremely difficult in terms of maintaining a balanced program. However, our goals have not changed.

QUESTION. I notice in your statement (page 11) you say, "As a result of the progress we have been making in SDI research, the balance is shifting between the price that the U.S. and its Allies continue to pay for voluntarily keeping our SDI Program structured within the bounds of the more restrictive view of the ABM Treaty and our overall security requirements."

Are you saying we should scrap the ABM Treaty? Are any of the planned experiments, demonstrations or tests of any systems or components of SDI as now structured going to violate the "restrictive" or "traditional" interpretation of the ABM Treaty?

ANSWER. The SDI research program is being conducted in a manner fully consistent with all U.S. treaty obligations. The President has directed that the Program be formulated in a fully compliant manner, and the DoD has planned and reviewed the Program (and will continue to do so) to ensure that it remains compliant.

If the broad interpretation of the ABM Treaty were adopted, it would result in higher levels of confidence in the technologies involved, and, if adopted early enough in the Program, would produce time and cost savings. At the present time, all programs and experiments are to be conducted in compliance with the restrictive interpretation of the ABM Treaty.

QUESTION: Are you aware that Senator Nunn, in a series of statements on the floor of the US Senate, has utterly demolished the so-called "broad" or "legally correct" interpretation of the ABM Treaty advanced by the Administration? Is the SDI Office planning, conducting or considering any activity whatsoever which would violate the interpretation of the ABM Treaty as spelled out by the Senator.

ANSWER: I am aware that Senator Nunn made several statements concerning the ABM Treaty as to its negotiating history, its ratifications and the subsequent practice of the parties in applying the Treaty. These statements by Senator Nunn do not, in my view, "utterly demolish" the so-called "broad" interpretation. Judge Sofaer, the State Department Legal Adviser, has considered Senator Nunn's comments in his analysis of the Treaty's negotiating history and ratification, and will also do so in his study of subsequent practice. The SDI Program continues by Presidential direction to be conducted according to the so-called "restrictive" interpretation.

QUESTION: Senator Nunn has said that development or testing of the SBKKV and associated technologies would be illegal under the ABM Treaty regardless of whether the "broad" or "traditional" interpretations are applied. Do you have a position on that question?

ANSWER: The question of whether the SBKKV is part of an ABM system based on other physical principles is currently under review.

Question: The heavy lift launch vehicle is estimated to require $4B in the FYDP, plus many billions after that possibly a total of $13-18B, according to DoD. General, what is the best estimate of total cost to develop this vehicle and how much will NASA be willing to pay?

Answer: Development cost of the ALS is projected to be $1.5B for early technology development, $6.6B for development of the system, and $8.9B for facilities. Over the FYDP, NASA has tentatively allocated approximately $2B.

QUESTIONS SUBMITTED BY SENATOR DECONCINI

Question. General, there was a major reorientation of the SDI program late last December. How is this shift, and any other change in emphasis in the overall program and each of its five major sub-programs since the budget was presented last year, reflected in terms of budget dollars, experiments, etc., proposed in the FY88 and FY89 budgets and how have program funds been redirected to emphasize research with early deployment potential? On what basis was each major shift made technological progress, Congressional budget cuts, policy decisions, etc?

Answer. There was not a major reorientation of the program. The FY87 budget request addressed the requirements of an early 1990s decision milestone. The basic building blocks of the program consists of a technology development program and technology validation efforts to confirm feasibility.

The appropriation was a reduction in excess of 30% of the request. Clearly, a reduction of that amount must be applied across the entire program. As a consequence of Congressional action on the FY87 budget request, all program elements were reduced. As an example, the major impact on the Directed Energy program was to terminate a major excimer laser project and delay the Neutral Particle Beam Integrated Space Experiment by about two years. These efforts represented secondary approaches within Directed Energy. The ground based free electron laser represents a principal option and funding for this effort was only slightly reduced.

The $3.2 billion appropriated permits only limited technology development for the entire multilayered defense and responsive threat. As a result, overall system performance risk has increased, technical validation schedules for some systems were seriously affected, e.g. SSTS, BSTS, TIR, NPB, EML, etc., and midcourse surveillance and discrimination for the responsive threat has been delayed.

QUESTION. There are three criteria which the Executive branch and Congress have agreed should be the principal measures by which to assess the strengths and weaknesses of ballistic missile defenses: 1) military effectiveness; 2) survivability; and 3) cost-effectiveness at the margin, meaning it costs the defense less to stay ahead of the offense in the countermeasures and counter-countermeasures competition. How do the early deployment missile defense architectures being considered meet the three essential criteria? Can these early deployment systems meet these criteria without the deployment of additional capabilities embodied in the more futuristic missile defenses available in the systems and architectures contemplated for later deployment?

ANSWER. It is most likely that future decisions on deployment will have to be made on the basis of defensive options, each of which would provide increments of protection from ballistic missile attack. We continue to believe that the defense resulting from the various increments must be expected to meet our basic criteria. Thus, the development and deployment of the initial phase of an evolutionary system should provide a base upon which the larger, integrated system can continue to be built and should perform a militarily useful function that contributes an increase in our security commensurate with the commitment of resources involved.

QUESTION: Concerns have been raised that, in developing those systems oriented toward early deployment, the SDI program has altered the effectiveness criteria (Both in terms of the three above-mentioned criteria and specific contractual requirements for kill probabilities, types of targets to be engaged, trajectory phases for required engagement, years of operational effectiveness before counter by Soviets, survivability, etc.) established for those systems earlier in the program, before the major reorientation was decided. Have these criteria been altered and what is the justification for these changes?

ANSWER: Developing SDI Architectures is a highly iterative process which requires the System Architects and the individual technology specialists to work closely together. Once a candidate defense system architecture is defined the performance requirements of the defense subsystems may be established. As a result of this process, the performance requirements of the individual subsystems may be increased or decreased depending on the configuration of the system. The criteria for the overall system have not been altered. The first requirements of a Strategic Defense system is military effectiveness. A defense against ballistic missiles must destroy enough of the offense's attacking force to deny him confidence that he can achieve his objectives. Secondly, the system must be survivable. System survivability means that the defensive force as a whole must be able to achieve its mission despite attempts to degrade the capability of some of its components. Thirdly, the system must be "cost effective." Cost effectiveness is not just an economic issue. The SDIO seeks defensive options that are able to maintain their defense capabilities more easily than countermeasures could be taken to try to defeat them just as with other military systems.

We continue to believe that the defense resulting form the various increments must be expected to meet our basic criteria. Thus, the development and deployment of the initial phase of an evolutionary system should provide a base upon which the larger, integrated system can continue to be built and should perform a militarily useful function that contributes an increase in our security commensurate with the commitment of resources involved. This would also increase arms control negotiating leverage for balance reductions in offensive weapons.

QUESTION: SDI critics contend that the experiments SDI has conducted do not truly reflect the complexities inherent in an operational missile defense system. How would you compare the technologies and capabilities present in last September's important Delta 180 experiment, in which two space vehicles collided, to those required for an operational space-based kinetic kill vehicle missile defense system?

ANSWER: The hardware flown in the Delta 180 space experiment was deliberately selected to not be capable of substitution for an ABM component, to be compliant with the ABM Treaty. Consequently, the technologies and capabilities of that particular hardware were, by design, significantly below operational requirements. However, many aspects of the experiment represented major advances towards the required capabilities. Some of these elements are summarized below.

Guidance and Control - The guidance and control equations [deleted].

Sensor data - The sensor data collected from the instruments located on the target stage are of proportions approaching that of a major breakthrough. Although most of this information is of high technical classification, even the least capable sensor, a low cost Maverick anti-tank weapon seeker, demonstrated surprising capabilities at distances exceeding 300 miles. Likewise, the world's first laser radar to fly in space verified the use of this type of device as both a fire control radar and interceptor seeker.

Experimental computer software - To design, test and conduct the experiment, over 1,000,000 lines of new computer code were written in less than one year. This software could not be fully tested prior to launch, but worked flawlessly during the experiment. Although a very small program compared to an operational ABM program, the software verified the necessary disciplines and techniques.

Battle management/Command, Control and Communication - The Delta 180 experiment utilized over [deleted]. This network also demonstrated damage tolerance, [deleted]. This network was the most complex ever attempted by the U.S., and represents a pre-prototype of the technology required for an operational system.

Question. How would you compare the technologies and capabilities inherent in the ERIS (outside the atmosphere) and HEDI (within the atmosphere) ground-launched functional test vehicle interceptor experiments with operational ERIS and HEDI systems ground-launched missile interceptor defenses?

Answer. The capabilities of these two systems are very similar to the operational systems. However, there are significant differences in the size, weight, and cost.

Some critical issues associated with exoatmospheric hit-to-kill were largely resolved by the successful HOE experiment in 1984. The current ERIS program is focused on resolving the remaining issues and the design and test of a lightweight, very low cost baseline interceptor. The functional test validation vehicle will closely emulate the components, functions and capabilities of the baseline. The low cost and weight is based on projected mid 1990's technology. An important aspect of the baseline is that it addresses projected advanced threats.

Since there was no predecessor program to HEDI, with a vehicle capable of hypervelocity optical homing within the atmosphere, the current program is strongly oriented on technology and concerned primarily with resolution of critical issues. The functional test validation vehicle design is based on the lowest cost experimental program capable of resolving these issues, without strong regard for size and weight in the interceptor. There is a significant degree of functional emulation between the test vehicle and an operational interceptor. However, the operational interceptor should, for example, weigh less than half the test vehicle. Although the test vehicle will not achieve the full operational burnout velocity requirement, since existing propulsion systems are being used, it will explore the full range of forces acting on the vehicle. For example, it will accomplish some intercepts lower in the atmosphere, where the heating and dynamic pressure are the same as the maximum projected for an operational system.

QUESTION. You are seeking a $500 million supplemental for fiscal 1987 to restore some of the money Congress denied you last year, after being warned repeatedly that such cuts would force you to delay or cancel programs, and to initiate a major new program, known as the "heavy lift launch vehicle." Congress usually views supplementals as being for emergency needs or unexpected requirements, and not for adding money already denied, or for new programs. Can you also tell us what emergency, or unexpected, requirements have occurred in the three months since Congress finished last year's budget work that might cause it to change its decisions and restore some of this money to the SDI Program? Has the Soviet threat changed dramatically, in a way we are unaware of, or is some new information now available?

ANSWER. The Supplemental request for the heavy lift launch vehicle, also known as the advanced launch system (ALS), has become an urgent issue. This effort is essential to assuming a role of leadership in space. Current space systems are capable of meeting only limited transportation needs. A system must be designed to meet future mission requirements of the Department of Defense, NASA and civilian space endeavors. Additionally, supplemental funds are necessary for technology development efforts related to low cost access to space and space operations, and for new and novel approaches to other programs received since the submission of the fiscal year 1987 budget request.

The launch on May 15, 1987, of the new SLX-17 heavy lift booster by the Soviet Union demonstrates the Soviet commitment to their space launch capabilities. This new capability will greatly add to their large variety of space launch vehicles while the U.S. lacks the capability to launch its most important satellites because of failures in two systems. Whatever the Soviet Union chooses to do in space, be it to deploy military space systems or advanced civil or scientific payloads, they will not be limited by space transportation capabilities. The U.S. cannot make that same statement.

Question: Can you also tell us why your new heavy lift launch vehicle request is now "urgent," as you have said? Although the specifics of this part of the request may not have been known in October, you told us last March (after the shuttle disaster) you needed a new space transportation system and were studying heavy lift options?

Answer: The request is "urgent" because we need to get started in the technologies areas required for a heavy lift capability now. Any delays in starting the technology development will cause an equal or greater slip in the IOC of either the interim or objective vehicle. Because of the long lead times associated with the technology development plus the vehicle development, the urgency is to get started so that we can have adequate time for technology development prior to initiation of vehicle development.

Question. Can you tell us these supplemental requests cannot wait to be considered as part of the fiscal 1988 budget request, and what impact their denial would have on early and later deployment missile defense options being considered?

Answer. The supplemental is necessary to retain key aspects of the original program pace and direction. The supplemental permits most of the planned FY87 program to continue until FY88. The supplemental combined with the full FY88 request will result in only minor delays in the SDI plan.

The $3.2 billion appropriated permits only limited technology development for the entire multilayered defense and responsive threat. As a result, overall system performance risk has increased, technical validation schedules for some systems were seriously affected, e.g. SSTS, BSTS, TIR, NPB, EML, etc., and midcourse surveillance and discrimination for the responsive threat has been delayed.

Some of the technical validation schemes for many vital programs such as Boost Surveillance and Tracking System, Terminal Imaging Radar, Neutral Particle Beam and the Electromagnetic Launcher. Significant funding set backs and the need for space related investment since the FY87 budget submission have prompted the request for a supplemental appropriation of $500 million. Specifically, the supplemental is essential for the following reasons:

(a) Partially restore discrimination efforts in Boost Surveillance and Tracking System and the Neutral Particle Beam as well as other programs;

(b) Partially restore ERIS, Space-based Interceptor, and HEDI interceptor technology validation schemes;

(c) Improve the Ground Based Laser schedule; and

(d) Increase the investment in space transportation and operations.

Furthermore, the supplemental request for Advanced Launch System (ALS) technology and system research has become an urgent national issue. The ALS is essential to assist in assuming the nations leadership in space.

Our current space systems are capable of meeting only limited transportation needs. A system to meet future mission requirements of the Department of Defense, NASA and our civilian space endeavors.

BM/C3 system validation effort is necessary to restore the critical balance between technology development and validation. Risk is reduced in establishing a battle management system and brings the battle management effort to the overall system timeline.

The FY88 budget request assumes appropriation of the supplemental request. The supplemental permits the program to regain schedule, maintains essential technology validation efforts and ensures the informed decision on whether to deploy advanced defenses does not slip by one year or more. Lack of space transportation support would delay initial deployments, later deployments would be impacted by surveillance and midcourse discrimination delays for the responsive threat.

Question. General, your prepared statement refers to the relationship the SDI program has to efforts to improve our conventional military capabilities. Could you elaborate on which aspects of the SDI program are most applicable to improving our non-nuclear military capabilities, and whether the individual military services are being aggressive enough in taking advantage of any of these components of your program?

Answer. There are significant technology and system "spinoff" opportunities provided by numerous ongoing SDIO projects that are clearly relevant to our conventional non-nuclear military capability. Some of the more promising SDI developments, many with fairly near-term application to conventional defense, are: electromagnetic guns ("rail guns") that launch guided and unguided projectiles at velocities far exceeding existing conventional guns; optical (infrared, ultraviolet and visible spectrum) and radio frequency sensors that can detect, identify, and track low-observable targets at long ranges in a severe jamming environment and can lead to superior multispectral seekers for making our tactical missiles "smarter"; advanced communications, multiprocessors, and computer software that will permit reliable and affordable command and control over large and widely distributed land, sea, and space forces; high power microwave systems that offer both long range and wide area destruction or disruption of vulnerable electronic components and sensors; lasers that can rapidly destroy hardened targets or burn-out vulnerable optical sensors at long ranges; and advanced computational techniques and test facilities that can be used to estimate, measure and project the vulnerability of missiles and other targets to kinetic energy and laser weapons.

The Servides and other Defense Agencies are working closely with the Office of the Secretary of Defense to develop a Conventional Defense Initiative/Balanced Technology Initiative program plan requested by Congress last Fall (Section 221 and 222 of the FY87 Authorization Conference Report). The plan will include applications of SDI spinoff to programs in such conventional defense areas as armor/anti-armor, smart weapons, surveillance and battle management, tactical missile defense, and defense suppression. The Navy, as part of a major study under the National Academy of Sciences, is currently assessing the SDI spinoff implications to future naval forces. Similar application studies by other Services and Defense Agencies might help to ensure greater exploitation of SDI spinoff.

QUESTIONS SUBMITTED BY SENATOR GARN

QUESTION: To what extent is it necessary to have SOPC for test missions planned by SDIO in the early 1900s?
ANSWER: Requirements exist for space operations control facilities that can be dedicated to manned military missions. However, work-arounds at NASA's Johnson Space Center have been adequate to date. Such temporary modification of NASA's procedures and facility set-up are expected to be adequate for SDIO manned test missions in the early 1990s.

QUESTION: Is it critical for the SDI Program to have a Top Secret control center? If not, what measures will have to be taken to protect sensitive payloads?
ANSWER: SDIO has no manned space missions planned at this time that would require a top secret control center. However, if top secret data is generated, one or more top secret data processing rooms would be required.
QUESTION: Is it necessary for SDI related missions to have the whole orbiter Top Secret secured, or only the payloads?
ANSWER: Some SDI payloads may require a dedicated DoD Space Shuttle mission as do other DoD payloads. The security requirements for SDI payloads would be similar to past and planned requirements of other DoD payloads.

QUESTION: Will double encryption of the payload be enough to guarantee security? What would you estimate be of the associated costs to guarantee the essential security needs of SDI tests?
ANSWER: The costs to guarantee security requirements of SDI tests would depend upon the specific test requirements, but would be similar to such costs for other DoD payloads. Encryption requirements are dependent upon the operation of the payload and security level of data it generates.

QUESTION. In the post-Challenger environment, the Department of Defense initiated a review of its space policy. This policy places a strong emphasis on the role of the military man-in-space to support such future programs as SDI. What is the status of the revised DoD space policy? Can we expect to be provided with a copy of the document once it is completed?

ANSWER. The Secretary of Defense has approved the DoD Space Policy. The unclassified version is attached. The military Man-in-Space section is the first policy governing the potential use of military man-in-space, and formalizes a tri-service effort begun by the Air Force in 1985. That effort seeks to fulfill the DoD Space Policy by using our nation's existing Space Shuttle, and possibly the Space Station, to explore military man's utility in research, development, and enhancing all existing military missions.

March 10, 1987

DEPARTMENT OF DEFENSE SPACE POLICY
(UNCLASSIFIED)

SCOPE AND PURPOSE

This DoD space policy applies to all space-related activities of the Department. The purposes of this policy are to guide all space-related activities within the Department, and to serve as an input to the formulation of national space policy.

BACKGROUND

Major changes have occurred which warrant a revision of the 1982 DoD space policy. These changes include the Strategic Defense Initiative, the revision of the nation's launch philosophy, the successful testing of the anti-satellite system against an object in space, the formation of unified and service commands for space, the emergence of commercial space enterprises and the hesitancy of the private sector to invest in large space ventures, the initiation of a manned space station program with international involvement, the increasing commitment on the part of other nations towards space exploitation, and the stringent funding constraints imposed by budget limitation legislation.

The Soviet Union continues its major national commitment to the military exploitation of space. This commitment will result in major new space systems in the future which will enhance all aspects of their space program and the support provided Soviet terrestrial forces. The Soviet space efforts aim at Soviet dominance of space.

DoD SPACE GOALS

The primary DoD goal in space is to provide operational capabilities to ensure the U.S. can meet national security objectives. Contributory goals include a strong and forward-looking national space technology base, a healthy space industry to support national security and support to our Allies.

DoD space efforts will contribute to the national security objectives by: 1) deterrence, or if necessary, defense against enemy attack; 2) assuring that forces of hostile nations cannot prevent our own use of space; and 3) enhancing operations of U.S. and Allied forces by space systems. These efforts include protecting the peace and decreasing the incentives for attack and enemy escalation by providing secure, survivable means for collecting and transmitting information, and by providing the means to counter enemy advantages through U.S. space-related and strategic defense operational capabilities.

GENERAL POLICY

DoD space policy supports and amplifies U.S. national space policy. Space is recognized as being a medium within which the conduct of military operations in support of our national security can take place, just as on land, at sea, and in the atmosphere, and similarly from which military space functions of space support, force enhancement, space control and force application can be performed.

RESEARCH AND TECHNOLOGY DoD will aggressively conduct research and technology development, in cooperation with other research organizations, to preserve and enhance a strong technology base and will emphasize leadership in technology areas having the greatest potential to advance military space capabilities beneficial to national security. DoD will encourage innovation to increase capability and reduce cost; will encourage private sector technology development in connection with commercial exploitation of space and will endeavor to use products and procedures developed by commercial space enterprises. DoD, in cooperation with other agencies, will protect against the transfer of space technologies, if such transfer is potentially detrimental to the national security interest of the United States.

CONTINGENCY RESPONSE DoD will maintain development, acquisition and budget planning activities to be able to respond effectively to major space contingencies.

MILITARY MAN-IN-SPACE DoD supports the potential use of military man-in-space. DoD will ensure that the unique capabilities that can be derived from the presence of military man-in-space shall be utilized to the extent feasible to perform in-space research and development, and to enhance existing and future missions in the interest of national security. DoD will actively explore roles for military man-in-space focussing on unique or cost-effective contributions to operational missions.

ARMS CONTROL DoD space activities will comply with the national policies concerning arms control. DoD planning will include provisions for appropriate responses to possible breakouts from existing arms control treaties. DoD will advise the President on the military significance of potential arms control agreements.

ACQUISITION AND OPERATIONS DoD will make every effort, including use of innovative techniques, to streamline the design and acquisition process, and simplify space operations to provide timely support to users while reducing acquisition and life cycle costs to a minimum consistent with meeting operational requirements. Cost reduction efforts should be an integral part of analysis of missions, systems design, and operational capabilities.

SPACE DEBRIS DoD will seek to minimize the impact of space debris on its military operations. Design and operations of DoD space tests, experiments and systems will strive to minimize or reduce accumulation of space debris consistent with mission requirements.

SECURITY Security measures will be implemented to protect critical aspects of all DoD space activities.

COOPERATION WITH OTHER SECTORS DoD will actively cooperate with the civil and commercial space sectors to insure that all sectors benefit from technologies, facilities, and support services available to the nation.

PUBLIC AFFAIRS Public affairs policies will be structured to provide general information to the public on DoD space activities, consistent with the need to protect national security information. Unclassified contributions of military space activities to the deterrent posture of the U.S. as well as their support to scientific and technological endeavors may be publicized. Flight-specific guidance for public affairs release will be developed by appropriate offices responsible for public affairs and will be structured to protect the identity, mission and associated operations of DoD space activities.

SPACE SUPPORT POLICY

Space support functions are those required to deploy and maintain military equipment and personnel in space. They include activities such as launching and deploying vehicles, maintaining and sustaining space vehicles while on orbit, and recovering vehicles if required.

ASSURED MISSION CAPABILITY DoD will develop and maintain the capability to execute space missions regardless of failures of single elements of the space support infrastructure. The requirement for assured mission capability will be considered and implemented at all stages of system development, acquisition and operations. Specifically, tradeoffs between cost, lifetime, survivability, proliferation, and related factors will be assessed during all phases to maximize assured mission capability. DoD will develop and maintain an assured mission capability through robust satellite control, assured access to space, and on-orbit sparing, proliferation or other means as appropriate.

Robust Satellite Control Future DoD space systems should emphasize robust satellite control. This may include autonomous satellite operations, survivable command links, and internetting of space operations control centers into an architecture employing interoperability and mobility to enhance survivability.

Assured Access to Space DoD will strive to develop and maintain the capability for assured access to space in peacetime and through levels of conflict as determined by national security needs. DoD space launch capability will comprise a mix of both manned and unmanned systems balanced to support national security mission needs best. Unmanned vehicles will be the primary launch vehicles for national security payloads not requiring a manned presence in space. DoD will control all phases of military space launch missions.

Distributed Access When critical DoD payloads uniquely perform a mission, and when possible, they will be capable of launch by more than one launch system and one launch site to ensure payloads can be placed in orbit regardless of specific launch capability available. When two critical DoD systems have similar or overlapping primary mission capabilities, they should be launched on different launch systems when possible.

Commercial Space Launch DoD will facilitate commercial launches on a non-interference basis. DoD space payloads may be launched by commercial launch vehicles provided that DoD and national security requirements are met. DoD will develop and implement the necessary plans and agreements to allow the contingency commercial launch of compatible payloads.

New Space Support Concepts DoD will vigorously pursue new support concepts, especially launch-related concepts, aimed at substantially reducing costs while improving responsiveness, capability, reliability, availability, maintainability, flexibility and the ability to operate in peace, crisis and war.

FORCE ENHANCEMENT POLICY

Force enhancement functions are those space-related support operations conducted to improve the effectiveness of both terrestrial-and space-based forces. Force enhancement includes such capabilities as communications, navigation, and surveillance.

These force enhancement capabilities will be structured to provide effective operational support to military forces in peace, crisis and conflict. System developments will emphasize increased responsiveness to the requirements of operational military forces.

Civil/commercial/allied capabilities may augment DoD systems to support military space force enhancement requirements, particularly if primary DoD capabilities were to be lost. DoD will determine the military requirements for and the nature and extent of such augmentation to DoD space assets. DoD, with non-DoD space system owners/operators, will plan for and implement arrangements and procedures, including cost sharing and reciprocity arrangements, as appropriate, to enhance the utility of these systems to complement national security systems and deny their use and control to adversaries as appropriate to national security interests.

SPACE CONTROL POLICY

Space control functions consist of operations that ensure freedom of action in space for friendly forces while limiting or denying enemy freedom of action when so directed by the National Command Authority. They include satellite negation and satellite protection.

It is important for DoD to ensure continuing capability for the control of space by preserving or acquiring those capabilities to surveil and monitor continuously all militarily significant activities in space. This requires complementary terrestrial- and space-based systems.

DoD will develop and acquire operational space control capabilities to deter or, during conflict, protect against hostile space-based threats to the U.S. and its Allies.

Anti-satellite DoD will develop and deploy a robust and comprehensive anti-satellite capability with programs as required and with initial operational capability at the earliest possible date.

Space System Protection DoD space systems will be designed, developed and operated to ensure the survivability and endurability of their critical functions at designated levels of conflict. DoD will develop and operate space systems which balance capability and survivability to deter attacks by creating a dilemma for adversary attack planners by responding to these attacks with both space and terrestrial force responses.

FORCE APPLICATION POLICY

Force application functions consist of combat operations conducted from space.

Consistent with treaty agreements and national policy, DoD will conduct research on, plan for, and develop, to the point of readiness for use, the space technologies which may permit a defense against ballistic missiles.

QUESTION. Can you provide for the record SDI's planned space lift requirements for testing?

ANSWER. The SDI payload requirements which testing would be intended to verify to be satisfied are similar to requirements of Space Shuttle cargo bay payloads.

QUESTIONS SUBMITTED BY SENATOR MCCLURE

DoE Participation in the SDI Program

Question. How does the DoE participate in the SDI program?

Answer. Department of Energy participation in the SDI program is of two kinds. The first kind consists of efforts that fall within the charter of the DoE, and are therefore funded from the DoE's budget. The second kind consists of efforts that fall within the charter of the DoD, are funded from the DoD's budget, and are performed by the DoE as DoD's executing agent, in a manner similar to the DoE's being a DoD contractor. This latter kind of effort is known as a "reimbursable" effort.

Within its own budget, the DoE currently conducts research on nuclear weapon and space power concepts for the SDIO. While the emphasis of SDI research is on nonnuclear technologies, it is important to investigate nuclear driven directed energy weapons to understand the potential of any similar systems that an adversary might develop, as well as to determine the feasibility of these concepts for future SDI options.

In addition to weapons development, the DoE is part of a tri-agency group (including DoD and NASA) funding the development of the SP-100 space nuclear reactor. This program focuses on developing the technology base needed to provide safe, reliable electric power for a variety of civilian and military missions in the 1990s and beyond. The DoE is the executing agent for the SP-100 program. The DoE also cofunds the nuclear work ongoing in the technology development effort for power needs greater than those provided by the SP-100 program.

Finally, the DoE funds and conducts survivability studies and threat assessments via nuclear testing and simulation. The resulting data are used to define technology requirements for the SDIO.

National Laboratory Utilization

Q: To what extent are DoE's national laboratories utilized in your research effort?

A: Overall, approximately 10-15% of the SDI budget goes to support work done by the National Laboratories for the SDI program, on a reimbursable basis. The majority of the work is done at the Los Alamos National Laboratory, the Lawrence Livermore National Laboratory, and the Sandia National Laboratory. The major reimbursable activity at the Los Alamos National Laboratory is the neutral particle beam program, at Livermore the free electron laser, and at Sandia there is a mixture of advanced technologies to be integrated into a Strategic Defense Facility. Other National Laboratories such as Argonne, Brookhaven, Oak Ridge, and Idaho National Laboratory also contribute to the SDI research effort.

Question. What percentage of your budget goes to the DOE effort?

Answer. The DoE supports SDI in two basic ways, through reimbursable support to DoE National Laboratories for performing direct SDIO mission oriented work, and through DoE funded support that falls within its statutory role of nuclear weapons research.

The planned FY87 reimbursable effort is approximately $310 million. This compares with $300 million experienced in FY86. Therefore approximately 10 percent of the SDIO budget is consumed in DoD reimbursable support by DoE laboratories.

The DoE funded program from which SDIO also shares in the information and output was Congressionally funded at $360 million in FY87. This includes $317 million for nuclear directed energy weapons effort and $43 million nuclear energy research effort for space nuclear power. In addition, DoE will consume $32 million from FY86 DoD funds provided by a Congressionally approved transfer during FY87.

Question. Please explain any cost sharing arrangements between the DOE and the SDIO.

Answer. Many technology development efforts have dual application in both SDIO and DOE mission areas. Some examples of jointly funded research efforts include:

Multimegawatt - the basis of this effort is to develop a power technology base both nuclear and nonnuclear in the multimegawatt regime.

SP-100 - The objective is to develop a nuclear power supply for satellite operations in a space environment.

Nuclear reactor driven laser - to investigate the potential of directly generating lasing from nuclear reactors.

Strategic Defense Facility - this effort provides, per Congressional direction, above ground facilities for DOD and DOE research.

Close coordination of all elements of this joint program are effected through special interagency coordinating groups with DOD and DOE representatives. A Memorandum of Agreement (MOA) between DOD and DOE provides detailed documentation of the joint responsibilities for supporting this program.

Joint SDIO/DoE Effort

QUESTION: How critical to the success of your program is the joint SDIO/DoE effort?

ANSWER: The technical competence and expertise of the people at the national laboratories is well known and needs no elaboration here. The work done by these scientists and engineers on innovative directed energy concepts, survivability of potential space-based strategic defense assets, and safe, reliable space power technology is fundamental to the SDI program. Their efforts have yielded a great deal of innovative thinking on and a number of new approaches to resolving some key issues the SDIO faces.

Additionally the DoE NDEW research is critical for the following reasons:

(1) To determine the feasibility and effectiveness of counterdefensive nuclear-drive systems that an adversary may develop for use against future U.S. surveillance and defensive systems.

(2) To understand the technical feasibility and impact that such concepts might have on our deterrent forces if utilized in Soviet defensive systems.

(3) To explore nuclear directed energy options as SDI possibilities if needed.

Question: Is the SDIO program dependent upon major advances in the area of power--in space and on the ground?

Answer: SDI system architectures will include a wide range of technologies to respond to the Soviet threat; although some of these will be capable of satisfying performance requirements with either existing technology or with reasonable extensions of existing technology, others will require major advances in power technology for full operational capability. For the space-based Neutral Particle Beam, Free Electron Laser, and Electromagnetic Launcher, over one-half the total platform mass and cost is attributable to the requisite power system. The SDIO Power Program is structured to conduct the research and development efforts which will be required to satisfy the needs of advanced weapons and sensor systems, which include both ground and space-based assets. Major advances in power system technology, both from the standpoint of prime power generation and that of power conditioning, are expected as the research proceeds. These advances require sound, consistent engineering efforts as opposed to fundamental physics research; performance levels must be increased by orders of magnitude but new science is not required. These advances will enable deployment of SDI systems consistent with overall architecture requirements.

Question: Please explain the SDIO Power Research Program.

Answer: The SDI Power Research Program is structured to address the following major areas of activity:

1. Requirements & Analysis
2. Multimegawatt Prime Power
    a. Nuclear
    b. Non-nuclear

3. Baseload Prime Power
    a. Nuclear (SP-100)
    b. Non-nuclear
4. Pulse Power/Power Conditioning

In each area, specific activities are under the direction of agents chosen for their experience in that area, applicability of interagency agreements and funding, etc. The Air Force is responsible for conducting the Requirements & Analysis activity for space-based power systems; they maintain a current data base on SDI power requirements and are directing studies being done by industry to define conceptual space power system architectures. The Army has the corresponding responsibility for ground based power systems. The nuclear Multimegawatt (MMW) program is a joint effort with DOE. The Idaho National Engineering Laboratory serves as the project integration office. This program is primarily oriented toward evaluation of reactor concepts, and advances in critical technologies, including fuels, instrumentation and neutronics. Non-nuclear Multimegawatt programs are primarily the responsibility of the Air Force, although some efforts are also managed by DOE and the Army. Non-nuclear technologies being pursued include rotating machinery (turbines, generators), electrochemical sources (batteries, fuel cells), and magnetohydrodynamic concepts. The SP-100 development program is jointly sponsored by DOD (SDIO), DOE and NASA; the current ground test phase is managed by DOE with project management supplied by NASA's Jet Propulsion Laboratory. The SP-100 program is focused upon developing the technology base needed to provide safe, reliable nuclear-generated electric power in the range of a few 10's of kilowatts up to approximately one megawatt for a variety of both civil and military missions in the 1990's and beyond. The non-nuclear baseload program is the responsibility of the Air Force. The focus of this effort is upon identifying techniques for achieving enhanced survivability of solar power systems. This program serves as the back-up to the SP-100 program. Power conditioning/pulse power programs are managed by the Air Force, DNA, DOE, and the Army. In this area, a number of critical component technology development projects are underway in energy storage, switching and radio frequency sources. The allocation of total resources to specific areas of activity is guided by the Independent Evaluation Group (IEG), whose members are government (non-SDI) experts nationally recognized for their ability to effectively administer complex research and development programs. Actual administration of the program is carried out through the Survivability, Lethality, and Key Technologies Office.

Question: Thermionic advocates cite design flexibility compactness and reliability as important advantages for in-core thermionic technology. What are your views?

Respondent: Thermionic energy conversion systems have potential to provide these important advantages in the design of space nuclear power sources, however, tech-

nical uncertainties have thus far inhibited designation of in-core thermionics as the energy conversion system for presently envisioned power sources. These technical uncertainties included the following concerns: fission gases causing fuel swelling and emitter distortion, resulting in an eventual short-circuiting of the thermionic cell; fast neutron flux induced swelling and cracking of the ceramic sheath insulator and insulator seal, resulting in the loss of cell integrity; the need to fabricate reliable inter-connective components between cells; and the irradiation performance stability and compatibility of cesium and cesium reservoirs.

Nevertheless, because thermionic energy conversion systems have high power to mass ratio, they are prime candidates for meeting space power requirements into the megawatt range. As a result, the Thermionic Fuel Element (TFE) Verification program continues work initiated during Phase I of the SP-100 program to establish the technical readiness of multi-year lifetime TFEs operating in megawatt-class space reactor power systems. The TFE Verification program is designing, fabricating and testing prototypic TFE components, including fueled emitters, sheath insulators, insulator seals, cesium reservoirs, and inter-connective components, under appropriate ex-reactor and in-reactor conditions. The test results will be used to interactively modify and refine component designs, and to validate performance models. The resolution of TFE technical feasibility concerns, and the demonstration of a prototypic, operational TFE at the culmination of the program, will significantly contribute to the technology readiness of candidate thermionic space reactor power systems being pursued under the Multimegawatt Space Reactor Program.

Question: I understand that the Thermionic Fuel Element Verification Program is a technology demonstration for power systems in the range of 500 kilowatts to 5 megawatts. What advantages do you see for this technology in SDI and other space applications?

Answer: Successful completion of the TFE Verification Program will resolve TFE feasibility concerns and provide a demonstration of a prototype operational TFE assembly suitable for incorporation in a nuclear power reactor for space power operations. Such a power source would offer a high power-to-mass ratio, inherently high reliability associated with direct conversion of heat to electricity, and long operating lifetimes compatible with SDI and other space missions. Potential applications of this technology of interest to both military and civilian missions include power sources for Orbital Transfer Vehicle, very high power Space Based Radar and the Mars Mission. Although TFE is targeted at the higher power applications, it can also serve as the back-up conversion technology for SP-100 if the technical issues with the out of core thermoelectric design cannot be resolved satisfactorily.

The TFE Verification program is one element of the larger Nuclear Multimegawatt Program. The overall goal of which is to establish feasibility of multimegawatt nuclear power sources to meet SDI requirements. Primarily oriented toward evaluation of conceptual approaches, the nuclear multimegawatt program seeks to identify critical technology paths or potential show-stoppers, and conduct generic technology advancements needed to establish concept feasibility.

QUESTION: Because power is considered a support activity, it does not capture the imagination in the same manner as beam weapons and the like. With current levels of funding, will thermionic technology be available when SDI will need it?

ANSWER: At current funding levels, thermionic technology will not be ready when SDI will need it because no supporting nuclear power reactor development program is underway. In-core heat to electric power conversion using TFEs involves intensely interactive design development between the nuclear reactor core and related heat transfer systems and the TFE elements. At the present pace, this design development effort cannot start until FY89. Assuming successful completion of the TFE Verification Program, space qualified in-core thermionic reactors could not become available until the first decade of the next century at best. Whether this timing is consistent with SDI needs will depend upon deployment decisions.

SUBCOMMITTEE RECESS

Chairman STENNIS. All right, as previously announced, we will take a recess now until next Tuesday morning at 9:30.

[Whereupon, at 12:20 p.m., Thursday, March 19, the subcommittee was recessed, to reconvene at 9:30 a.m., Tuesday, March 24.]

DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 1988

THURSDAY, MARCH 26, 1987

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 9:59 a.m., in room SD–192, Dirksen Senate Office Building, Hon. John C. Stennis (chairman) presiding.

Present: Senators Stennis [presiding], Johnston, Sasser, Stevens, McClure, Cochran, Kasten and D'Amato.

NONDEPARTMENTAL WITNESSES

FORMER SECRETARY OF DEFENSE

STATEMENT OF HON. DR. HAROLD BROWN, FORMER SECRETARY OF DEFENSE

STRATEGIC DEFENSE INITIATIVE

HEARING PROCEDURE

Chairman STENNIS. Our committee will come to order. We will proceed now with the testimony of some special witnesses that we have invited here today.

There are two roll call votes scheduled on the Senate floor this morning, beginning, I think, at 11:00 o'clock. We'll get that time in a minute.

I propose that we take a recess when that time comes and go to the floor and attend both roll calls, and return directly here.

INTRODUCTION OF WITNESSES

Now, without further ado, I want to extend a special word of welcome to our first witness. And we'll give our welcome, of course, to Dr. Miller, the other witness.

We have with us former Secretary of Defense Harold Brown who served four highly successful years as Secretary, and I know, in a personal way, what a valuable official he was, what a high standard he put upon his work, and how dependable he was in doing an outstanding job.

It's a pleasure to have you here, Doctor, and to thank you again for the service you rendered to which I have just referred.

Now, you are at home. You just proceed in your own way. If you have a written statement, you could put any of it or some of it in the record, just do as you wish on that.

But we'd like to hear you give some oral testimony, of course, and proceed in your own fine way.

Senator JOHNSTON. Mr. Chairman, may I say something briefly?

Chairman STENNIS. Yes, Senator Johnston.

Senator JOHNSTON. Thank you, Mr. Chairman, very much.

I don't want to make a long statement. I simply want to welcome, first, Dr. Brown, who is a real national resource.

There is no question in America today more vital than this question of SDI. It has the potential, according to its proponents, to put an astrodome over the country to make nuclear weapons obsolete, and to render us safe from this terrible scourge forever.

On the other hand, it has a potential, also, to break the bank, and also to take away from other defense efforts and initiatives.

No issue is more important. The presence and the value of these witnesses is absolutely vital. Dr. Brown, of course, as you point out, has this background, and credibility, that is so important to it.

Mr. Chairman, I would also like to thank Dr. George Miller for coming from Lawrence Livermore Lab who handles their program in SDI at Lawrence Livermore, the lead lab.

Chairman STENNIS. Senator Stevens.

Senator STEVENS. No statement, Mr. Chairman.

Chairman STENNIS. All right, Dr. Brown, you proceed in your own way. We'll have statements, questions and answers to follow from any members.

SUCCESS AND DEVELOPMENT OF SDI

Dr. BROWN. Thank you very much, Mr. Chairman. As always, I appreciate very much and value your friendship and appreciate the courtesy that you've always shown me as a witness, as an official.

And I appreciate the chance to testify before you and the other committee members this morning on the Strategic Defense Program.

Decisions taken on the purpose and nature of that program have substantial influence on U.S. national security and foreign relations. I have prepared some testimony. I'll try to go through it very quickly so we can get to questions.

My prepared testimony covers briefly my views on these questions.

First, what are the possible purposes of a strategic defense against ballistic missiles, and what's the likelihood of success?

Second, given those answers, what's the appropriate nature of and level of funding for the development program on ballistic missile defense? Is a plan for deployment timely now?

And third, is the traditional or the broad interpretation of the treaty correct, and what's the effect on the development program of the traditional interpretation?

PURPOSES OF SDI

A strategic defense against ballistic missiles can have a wide spectrum of purposes. At one end, defense of land-based ballistic missiles, command control facilities in order to enhance deterrence through the threat of retaliation, making more secure the U.S. ability to threaten, and thereby to deter, through threatening whatever the Soviet leadership most values.

The other end is the perfect defense of the United States and everything in it, military forces, cities, people and, in some versions, an equally perfect defense of U.S. allies.

Some purposes that lie in between in roughly increasing order of difficulty are: defense against some other military forces; defense of populations against a third-country attack; defense against accidental or unauthorized launch of a few missiles; defense against a light but sophisticated attack; limiting damage from major attack; and assuring survival of the United States although in a greatly damaged state, which is less than an astrodome, but which would certainly be a different situation than now exists.

FEASIBILITY FACTORS

The feasibility of these goals depends on many factors, not least of which is the definition chosen for success.

For most cases, including population defenses against Soviet attack, it seems to me that the so-called Nitze criteria are appropriate: cost-effectiveness at the margin; invulnerability of the defenses; and stability.

Another important factor is constraint through arms control on the numbers or quality of offensive forces.

Estimates will vary as to the comparative difficulty of various offensive countermeasures and defensive counter-countermeasures; the nature of Soviet strategy and goals; and the intensity with which they will be pursued.

My judgment is that the comprehensive, near-perfect defense of population will be infeasible at least for decades and probably forever against an attack by many thousands of warheads.

SURVIVABILITY FACTORS

Survival as a nation, which is that very ambitious but not ultimate goal that I described, is conceivable as a goal if arms control were to limit ballistic missile warheads to a few hundred, and the defense were 95 percent effective.

Ninety-five percent is by no means an effectiveness that's feasible with anything we know how to do, so I'm simply hypothesizing.

If you had a few hundred incoming warheads, ballistic missile warheads, bomber warheads, and could intercept all but 5 percent of them, then there would be some tens of warheads landing on the United States, catastrophic, disastrous, but conceivably survivable.

The other end, a cost-effective active defense overlay of some basing modes for land-based ICBMs is probably feasible.

It should be noted, however, that ground-based antiballistic missiles would suffice for this purpose. The present basing modes can't be defended cost effectively. A survivable basing mode with ballistic missile defense is feasible in combination with limitations of offensive forces.

And even ground-based, hard point defenses will probably excite concern about their actual or potential capabilities for population defense; certainly, we would be troubled about that possibility if the Soviets deployed hard point defenses.

So there's something to worry about before you did something like that, and at the moment I would not favor going ahead with it as a plan for deployment.

RESEARCH AND DEVELOPMENT PROGRAM

My judgments on these purposes and the likelihood of their achievement lead me to believe that a robust program of research and of technology development is justified for several reasons.

Some completely unexpected technological development that would make defense look much better is conceivable, though very unlikely. In other words, I and the majority of informed military technical opinion could be wrong.

Second, such a program is useful to deter, and as one response to, a Soviet breakout from the ABM Treaty.

SDI A NEGOTIATING TOOL

The SDI program has been a lever in negotiating, I think a very useful one, and will be an element in concluding any treaty on strategic arms.

Third, we should keep open an option for timely fullscale development and deployment of a ballistic missile defense overlay of ICBMs if ballistic missiles themselves are not limited, and the United States decides that it needs to have an ICBM force that can survive without warning; something for which there are no plans in the administration's program, by the way.

R&D PROGRAM FEATURES

The R&D program that follows from such an assessment of its purposes should stress first, more advanced technologies: ground-based free electron lasers; space-based chemical lasers; and so forth, for multiple kill, especially in boost phase intercept.

I suspect you may hear more about that from Dr. Miller later.

Second, discrimination methods, both for boost phase and for midcourse. This should include passive, active, and interactive discrimination. The latter should cover such medium-term approaches as neutral particle beams, and long-term ones such as the X-ray laser.

Passive discrimination should include a broad spectrum of wavelengths. Active discrimination should include, among other things, radar and optical imaging.

Third, ground-based hard point defense systems design and component development.

Fourth, research on space-based sensors of advanced design.

Fifth, command, control, and communications.

I think the management of the SDI program has improved significantly during the last year, at least in terms of the technical program and of systems studies.

On the other hand, policy-directed decisions appear to take even less account than before of the technical and military factors.

DEVELOPMENT OF THREE-TIER SDI SYSTEM

In my view, the idea of proceeding with development of a three-tier SDI system, which is now what's being talked about, space-based kinetic kill vehicles, which I'll call KKVs from now on, for use in boost phase; exoatmospheric late midcourse; and high altitude endoatmospheric terminal, with a decision on deployment within a few years, and beginning deployment of the three layers by 1993 or 1994 is unrealistic, and it wouldn't lead to an effective capability.

I should say that there are some interesting experimental results on boost phase detection of missiles. Detection, of course, has always been considered feasible.

There have been some useful advances in KKV technology. There has been some interesting analysis of self-defense of space-based systems.

But despite this, the KKV architectures appear to me too easily countered by a reactive defense.

Now it's been suggested that the Soviets are already committed on the design of the next generation of ICBMs, and couldn't begin to deploy fast-burn boosters by 1993.

If that were so, then the argument is, a three-tier system of modest cost—and whether modest means $50 billion or $100 billion or $150 billion is a matter of controversy—such a system is alleged to be able to intercept 25 percent of the Soviet ICBMs or 50 percent, and deny the Soviets a successful attack.

Now, whether 25 or 50 percent attrition does deny a successful attack depends on its nature and its goal, that is, of the attack.

DEPLOYMENT DATE

But more important, it's hard to credit the 1993, 1994 initial deployment date. That's 6 years from now. Six years is the same time period as elapsed between the Reagan Administration's 1981 decision to produce the B–1, which had begun development in the 1970's, but was modified somewhat in design after 1981, and the initial deployment of the B–1.

Seven years is also about the same time as it will take to deploy an aircraft carrier if the Congress appropriates the first funds for it this year.

Can anyone believe that these systems are anywhere near as complex as even the first slice of an SDI system, or that a first step SDI design is anywhere near as well defined as the B–1 was in 1981, or as an aircraft carrier is now, or that its components are as ready?

The question answers itself. If a fast-burn booster is not in development in the Soviet Union, it's because there is now no need for it.

A U.S. decision to proceed with a space-based KKV layer would motivate the Soviets strongly to develop and deploy fast-burn boosters, space mines, and other counters.

Those can be developed and deployed more easily, quickly and cheaply than the space-based KKVs.

The Soviets would be imprudent not to do so. And in these matters, the Soviets are not imprudent.

There's an argument about which is easier. I know which I would prefer to be given the task of doing.

SDI FUNDING

As to the appropriate level of SDI funding, I continue to think that a modest growth rate is justified, 10 or 15 percent a year, to provide some flexibility in exploring new ideas and carry out experiments, to see what sensors variously based on the surface, in the air, or space can do in finding and discriminating boosters, warheads, and decoys at various points in their trajectory.

I'm not saying that should be the only part of the program. I'm saying you need to allow some room in the program so as to be able to investigate new things like that.

Both the general budgetary pressures on defense and the likely inefficiency of a more rapid growth from what's already a $3-plus billion base, argue against more rapid growth, in the absence of a conviction that SDI has a fair chance of achieving a needed goal.

As you will recognize, I have no such conviction at this time.

INTERPRETATION OF ABM TREATY

Now, what about the proper interpretation of the ABM Treaty. My own recollection, as a member of the U.S. SALT delegation, was that the delegation's purpose was to prevent development and testing of ABM systems and their components, unless those were fixed land-based systems, while at the same time allowing development and testing of new kinds of ABM componentry, lasers, particle beams, forms of detectors other than radars, that would be associated with land-based anti-ballistic missiles.

The delegation thought that the Soviets had agreed to this, and that the treaty language expressed that agreement.

I continue to believe that. Although the negotiating record is ambiguous enough to leave some room for argument. But even there, I think the proponents of the narrow interpretation have the better case.

In any event, the treaty language, the testimony leading to the advice and consent of the Senate to its ratification, and the sum total of the behavior and statements of the parties, until the Reagan Administration's change over the past year, all support that view.

Incidentally, it's hard to think of a KKV as anything but an interceptor, based on the same physical principles as one that operates from the ground. Thus, if that particular form of space-based SDI is to be developed and tested, it seems to me that Agreed Statement D is a weak justification for asserting that such action is allowed even under the broad interpretation of the treaty.

EARLY DEPLOYMENT OF SDI

It's possible, Mr. Chairman, to hold the view that SDI development, testing and early deployment is vital to US security, indeed, to the survival of the US. I don't hold that view.

But if I did, I would suggest that the proper course is to exercise the supreme national interest clause, withdraw in 6 months time, and accept the responsibility for doing so.

In fact, if you're prepared to make the case that Soviet violations of the ABM Treaty have destroyed that treaty, you don't have to wait for 6 months. The treaty would be void, and you could withdraw immediately.

Again, you'd have to be prepared to take the political responsibility for doing it. I'm not, because I don't think that US supreme national interest is involved here. I don't think that early deployment is vital to U.S. security, or that development and testing of space-based systems is vital at this time.

How much more quickly could SDI research and development proceed under a broad interpretation of the treaty? Since the SDI office is still looking at alternative programs, as I understand it, any judgment I make must be tentative.

However, even a narrow interpretation requires further definition. Unilateral definition, in the absence of SCC or other bilateral considerations between the United States and the Soviet Union—and I would reserve judgment on the best way to make that interpretation.

But you'd have to interpret what component means and what testing means. I'd expect that a broad interpretation would allow tests to be carried out together that otherwise would have to be done separately.

That could save some time, and incur costs at a more rapid rate, although perhaps at a lower total cost.

No such experiments could be carried sensibly, as I read the SDIO's statements, before 1989 at the earliest, though planning and some expenditures might take place earlier.

But that approach I think misses the main point. It would be a mistake for the United States to erode the ABM Treaty, perhaps decisively, by embarking on such a program of space-based full scale development and testing.

It would be a mistake just as it would be a mistake to withdraw from the treaty.

Why? Because we don't have any basis on which to decide that an ABM deployment in space is in our national security interest. That seems to me to have been also the administration's opinion most of the time, at least until recently.

And we could find out a lot more about that over the next couple of years under the traditional interpretation of the ABM Treaty.

Erosion or abrogation of the ABM Treaty would have a major, and I think adverse, effect on relations with allies; on US-Soviet relations; and quite possibly on the US military position.

Let's keep the SDI a research program; do the necessary analysis and evaluations; have the necessary debate; and then make a national decision in the early 1990s as to what is the appropriate stance for that decade.

And I'll enter my whole statement in the record, Mr. Chairman.

Chairman STENNIS. Without objection, the entire statement of Dr. Brown will be entered in the record at this time.

[The prepared statement of Dr. Brown follows:]

PREPARED STATEMENT OF DR. HAROLD BROWN

FORMER SECRETARY OF DEFENSE

Mr. Chairman and Members of the Committee:

I welcome the opportunity to testify before you this morning on the strategic defense program. The decisions taken on the purpose and nature of the program have substantial influence on U.S. national security and foreign relations. In my prepared testimony, I will briefly present my views on these questions:

1) What are the possible purposes of a strategic defense against ballistic missiles? What is the likelihood of success?

2) Given those answers, what is the appropriate nature of, and level of funding for, the development program on ballistic missile defense? Is a plan for deployment timely now?

3) Is the traditional or the broad interpretation of the treaty correct? What is the effect on the development program of the traditional interpretation?

1. A strategic defense against ballistic missiles can have a wide spectrum of purposes. At one end is the defense of land-based ballistic missiles and command and control facilities in order to enhance deterrence through the threat of retaliation -- making more secure the U.S. ability to threaten whatever the Soviet leadership most values. At the other end is the perfect defense of the U.S. and everything in it -- military forces, cities, people -- and, in some versions, an equally perfect defense of U.S. allies. Some that lie in between, in roughly increasing difficulty, are defense of some other military forces, defense of populations against a third country attack, defense against accidental or unauthorized launch of a few missiles, defense against a light but sophisticated attack, limiting damage from a major attack, and assuring survival of the U.S. albeit in a gravely damaged state.

The feasibility of these goals depends on many factors, not least of which is the definition chosen for success. For most cases, including the population defenses against Soviet attack, the criteria of cost-effectiveness at the margin, vulnerability of the defenses, and stability seem to me appropriate. Constraint, through arms control, on the numbers or quality of offensive forces, is an important factor. Estimates will vary as to the comparative difficulty of various offensive countermeasures and defensive counter-countermeasures, of Soviet strategy and goals and the intensity with which they will be pursued. My judgment is that the comprehensive, near perfect defense of population will be infeasible for decades, and probably forever against an attack by many thousands of warheads. Survival as a nation is conceivable as a goal if arms control were to limit ballistic missile warheads to a few hundred and the defense were 95% effective (by no means an effectiveness that is feasible with anything we know). At the other end, a cost-effective active defense overlay of some basing modes for land-based ICBMs is probably feasible; it should be noted, however, that: (a) ground-based ABMs would suffice; (b) the present basing modes cannot be defended cost-effectively; (c) a survivable basing mode without ballistic missile defense is feasible in combination with limitations of offensive forces; (d) even ground-based hard-point defenses will probably excite concern about their actual or potential capabilities for population defense.

2. My judgments on these purposes and the likelihood of their achievement leads me to believe that a robust program of research and of technology development is justified for several reasons. Some completely unexpected technological development that would make defense look much better is conceivable, though very unlikely -- in other words, I and the majority of informed military-technical opinion could be wrong. Second, such a program is useful to deter, and perhaps as one response to, a Soviet breakout from the ABM Treaty. The SDI program has been a lever in negotiating, and will be an element in concluding, any

treaty on strategic arms. Third, we should keep open an option for timely full-scale development and deployment of a BMD overlay of ICBMs if ballistic missiles are not limited and the U.S. decides that it must have an ICBM force that can survive without warning.

The R&D program that follows from such an assessment of its purposes should stress:

a) more advanced technologies -- ground-based free-electron lasers, space-based chemical lasers, etc. -- for multiple kill, especially in boost-phase intercept.

b) discrimination methods, both for boost-phase and for mid-course. This should include passive, active, and interactive discrimination. The latter should cover such medium-term approaches as neutral particle beams and long-term ones such as the X-ray laser. Passive discrimination should include a broad spectrum of wavelengths; active discrimination should include radar and optical imaging.

c) ground-based hard-point defense systems design and component development.

d) research on space-based sensors of advanced design.

e) design of command, control, communications to operate the system, and the accompanying software.

The management of the program, it seems to me, has improved significantly during the past year -- at least in terms of the technical program and of systems studies. On the other hand, policy-directed decisions appear to take even less account than before of the technical and military factors.

In my view, the idea of proceeding with development of a three-tier SDI system -- space-based kinetic kill vehicles (KKVs) for use in boost-phase, exoatmospheric late mid-course, and high-altitude endoatmospheric terminal, to decide on deployment within a few years, and to begin deployment of all three layers by 1993 or 1994, is unrealistic and would not lead to an effective capability. Though there are some interesting experimental results on boost-phase detection of missiles (which has always been considered feasible), some useful advances in KKV technology, useful analysis of self-defense of space-based systems, the KKV architectures appear to me to be too easily countered by a reactive defense. It has been suggested that the Soviets are already committed on the design of their next generation of ICBMs, and could not begin to deploy fast-burn boosters by 1993; thus a three-tier system of "modest" cost (50 billion dollars, or 100, or 150) could intercept 25% of the Soviet ICBMs, or 50%, and deny the Soviets a successful attack. Whether 25% or 50% attrition does that depends on the nature and goal of the attack. More important, the 1993-94 initial deployment date is difficult to credit. Six years is the same time period as elapsed between the Reagan Administration's 1981 decision to produce the B-1 (which had begun development in the 1970s, but was modified in design after 1981) and its initial deployment. Seven years is about the same time as it will take to deploy an aircraft carrier if the Congress appropriates the first funds for it this year. Can anyone believe that these systems are anywhere near as complex as even a first slice of an SDI system, or that a first-step SDI design is anywhere near as well defined as the B-1 was in 1981 or an aircraft carrier is now, or that its components are as ready? The question answers itself. If a fast-burn booster is not in development in the Soviet Union, it is because there is now no need for it. A U.S. decision to proceed with a space-based KKV layer would provide a strong motivation for Soviet development of fast-burn boosters, space mines, and other counters. Those can be developed and deployed more easily, quickly, and cheaply than the space-based KKVs. The Soviets would be imprudent not to do so, and in these matters the Soviets are not imprudent.

As to the appropriate level of funding for SDI, I continue to believe that a modest growth rate is justified -- on the order of 10-15 percent per year, to provide some flexibility in exploring new ideas and carry out experiments to investigate what sensors variously based on the surface, in the air, or in space can do in finding and discriminating boosters, warheads, and decoys at various points in their trajectory. Both the general budgetary pressures on defense and the likely inefficiency of more rapid growth from a 3-plus billion dollar a year base argue against more rapid growth in the absence of a conviction that SDI has a fair chance of achieving a needed goal. As you will recognize, I have no such conviction.

3. With respect to the proper interpretation of the ABM Treaty, my own recollection is that the U.S. SALT Delegation's purpose was to prevent development and testing of ABM systems and their components unless those were fixed land-based systems, while at the same time allowing development and testing of new kinds of ABM componentry -- lasers, particle beams, forms of detectors other than radars -- associated with land-based ABMs. The delegation believed that the Soviets had agreed to this, and that the treaty language expressed that agreement. I continue to believe so, and both the treaty language, the testimony leading to the advice and consent of the Senate to its ratification, and the sum total of the behavior and statements of the parties until the Reagan Administration's change over the past year all support that view.

Incidentally, it is hard to think of a KKV as anything but an interceptor, based on the same physical principles as one that operates from the ground. Thus, if that particular form of space-based SDI is to be developed and tested, it seems to me that agreed statement D is a weak justification for asserting that such action is allowed under even the broad interpretation of the Treaty.

It is possible to hold the view that SDI development, testing, and early deployment is vital to U.S. security, indeed its survival. I do not, but if I did, I would suggest that the proper course is to exercise the supreme national interest clause, withdraw in six months time, and accept the responsibility for doing so.

How much more rapidly could SDI research and development proceed under a broad interpretation of the Treaty? Since the SDIO is still looking at alternative programs, as I understand it, any judgment by me must be tentative. However, even a narrow interpretation requires further definition -- unilateral, in the absence of SCC or other bilateral consideration -- of component, and of testing. I would expect that a broad interpretation would allow tests to be carried out together that otherwise would probably have to be done separately. That could save some time, and incur costs at a more rapid rate though perhaps at a lower total cost. No such experiments could be carried out sensibly, as I read the SDIO's statements, before 1989 at the earliest, though planning and some expenditures might take place earlier.

But that approach, I think, misses the main point. It would be a mistake for the U.S. to erode the ABM Treaty, perhaps decisively, by embarking on such a program, as it would be to withdraw from the Treaty. Why? Because we don't have any basis on which to decide that an ABM deployment in space is in our national security interest. That seems to me to have been also the Administration's position most of the time, at least until recently. And we can find out a great deal more about that over the next couple of years under the traditional interpretation of the ABM Treaty. Erosion or abrogation of the ABM Treaty will have major -- and I think adverse -- effects on relations with allies, on U.S.-Soviet relations, and quite possibly on the U.S. military position. Let's keep the SDI a research program, do the necessary analysis and evaluations, have the necessary debate, and then make a national decision in the early 1990s as to what is the appropriate stance for that decade.

RECESS

Chairman STENNIS. Gentlemen, it seems to me like we could well go over to the floor now. The vote is coming at 10:30. It's 10:20 now. And we could vote on both measures, and get started back over here.

I believe it would work better that way and utilize the time better, too.

Senator STEVENS. That's agreeable to me, Mr. Chairman.

I assume Dr. Brown understands we have two votes, and it'll take some time to get back and forth.

Dr. BROWN. I'm at your disposal all morning.

Chairman STENNIS. And that suits you all right, Senator?

Doctor, we'll be back as soon as we can get back. Hopefully, then, we will proceed to the end of the testimony.

All right, the committee will stand in recess, subject to the call of the chair. And that call is expected to be very soon after the second vote starts.

[A brief recess was taken.]

TALKING PAPER ON STRATEGIC NUCLEAR POLICIES AND PROGRAMS

Chairman STENNIS. Forgive that interruption. That was something that developed after these hearings were set, and couldn't be changed.

Dr. Brown, at the time of the interruption, we were just getting started here, and I wanted to get into some questions here.

And I'll request that any questions I do not ask be placed in the record for your further attention. That's in keeping with the good practices of our committees here, and it saves a lot of time for the witnesses too.

Do you have any further statement to make now?

Dr. BROWN. No, sir, I'm ready for questions, Mr. Chairman, if you are.

Chairman STENNIS. Well, my attention has been called to the fact that you made a statement and it was circulated in August, 1986, with five others who are authorities in this field. It has attracted some attention as being a favorable statement and reflecting your views. I would like to put that in the record, also, unless there is some reason you think it should not go in.

Dr. BROWN. No, sir, I would be delighted to have it entered.

Chairman STENNIS. Well, I ask unanimous consent, gentlemen, that Dr. Brown's statement of August, 1986, be placed in the record at this point.

[The information follows:]

SAIS

The Johns Hopkins Foreign Policy Institute
School of Advanced International Studies

August 1, 1986

The attached is a talking paper that includes recommendations on strategic nuclear policies and programs, arms control, and SDI. Its general thrust is endorsed by Messrs. Laird, Schlesinger, Scowcroft, Vance, and myself.

Harold Brown
Harold Brown

Introduction

The U.S. is faced with a set of interconnected decisions -- about relations with the Soviet Union, about U.S. nuclear strategy and nuclear forces of intercontinental and of intermediate range, about arms control, and about the Strategic Defense Initiative. All of these policy issues are influenced by Soviet behavior, by the present strategic balance and by trends in that balance, and by the perceptions of the allies and of the U.S. public. The time seems ripe for a combination of negotiated agreements and unilateral decisions on force structure and programs. One reason for this is the present state of U.S. military capabilities and technological potential. Another is the future uncertainties -- of different sorts -- in the U.S. and Soviet economies. A third is the juxtaposition of a new, more vigorous Soviet leader who may be able to adopt new policies with a popular U.S. president who has put into effect a military buildup and an assertive foreign policy.

The Soviets continue to develop and deploy a large force of ICBMs, with increasing counterforce capability, while reducing the vulnerability of their own strategic forces through hardening and mobility for ICBMs, and modernizing their ballistic missile submarines (SSBNs) and the missiles (SLBMs) that they carry. They are also modernizing their heavy bomber force, and introducing long-range cruise missiles launched from aircraft, submarines and the ground. The Soviets retain and modernize their air defense forces, continue to develop the antiballistic missile (ABM) forces allowed in the ABM Treaty, and carry on a large research program on advanced technologies applicable to ground-based and space-based ABM. We hold a spectrum of views about the nature of Soviet intentions and future capabilities, and each of us might emphasize different aspects of what follows. We nevertheless agree on these prescriptions, and commend them to the Administration and the Congress as a basis for U.S. policy and programs.

Specific Points

1. Strategic Offensive Forces (SOF). The overall purpose is to convince the Soviets that, whatever the situation, they would be worse off if they initiated a strategic nuclear exchange than if they did not, because U.S. forces would not be greatly degraded by a preemptive attack, so that a Soviet first strike would not achieve its objective: the U.S. retaliation would cost the Soviet Union much more than it could possibly gain.

a) The U.S. should maintain a triad of forces -- SLBMs, ICBMs, and bombers/cruise missiles. The purpose is to preserve and strengthen deterrence and enhance the stability of the strategic balance by assuring the capability of U.S. forces in the face of the Soviet force posture. Stability against the threat of preemptive strike, which would be greatest in times of crisis, is enhanced by avoiding overall force vulnerability to a single threat, be it antisubmarine warfare (ASW), ABM, accurate ballistic missile warheads targeted on ICBM silos, or a barrage of missiles aimed at blanketing the areas around bomber bases so as to destroy the alert bombers during their early flight.

b) U.S. strategic offensive forces should include a highly accurate and responsive capability that is not highly vulnerable to a preemptive attack and that is seen by the Soviets to be capable of fulfilling our national commitments. In practice that translates to land-based ICBMs, since they have a short response time and can be communicated with fairly easily. The size of that component of the U.S. force need not be equal to that of the Soviet ICBM force, in view of U.S. advantages in other force components. The objective is to encourage a move towards a world of survivable forces. The objective is promoted by reducing the number of warheads on both sides (and reducing also the ratio of each side's warheads to the number of aim points on the other side required to be attacked in a preemptive strike), and especially by discouraging Soviet concentration of their capabilities in heavy fixed ICBMs carrying multiple warheads. Such concentration erodes stability because it is so much less valuable in a second strike than in a preemptive strike. A situation in which a large Soviet ICBM payload cannot be threatened by U.S. ICBMs but U.S. fixed targets (including ICBMs) are threatened by Soviet ICBMs could encourage imprudent Soviet behavior in a crisis.

The value of the M-X program to U.S. security is contained in two roles: to reduce a potentially destabilizing imbalance in Quick Hard-Target Kill (QHTK) capability and to encourage Soviet willingness to negotiate sharp reductions in such capability. The basing and other characteristics of the M-X deployment should promote these two objectives while maximizing stability and U.S. negotiating leverage. The numbers should reflect the degree of success in achieving these M-X related objectives. At a minimum, U.S. leverage should be maintained through keeping open a production line.

The U.S. should conduct R&D on a follow-on SSBN to the Trident, to provide an option that avoids an indefinite continuation of the concentration of 200 warheads in one aim point. Work should proceed so that a decision can be made on whether to produce more Tridents or an alternative with fewer warheads per submarine after the 12th Trident.

c) The U.S. should assure that its strategic C^3 system can survive a preemptive strike. It should be made enduring insofar as a reasonable investment allows.

d) In terms of force structure, this corresponds to introduction during the next seven or eight years of the D-5 submarine-launched ballistic missile to modernize the SLBM force, and of the Advanced Technology Bomber (ATB) (and the advanced ALCM-air-launched cruise missile) and the Midgetman as needed to reduce the vulnerability of the U.S. bomber and land-based ICBM forces respectively to Soviet air defense and Soviet high-accuracy ballistic-missile attack. The options for deploying a new M-X basing mode (e.g. multiple protective shelters, tunnels, super hard, hard-carry) and a new submarine carrying fewer warheads than Trident during the following decade should be kept open. To these ends, B-1B production should be terminated at 100 and, M-X production should be continued at a low rate. The Midgetman performance specifications should emphasize mobility in a hardened mobile deployment. A 37,000 pound Midgetman missile weight could initially be deployed with a payload of one warhead plus penetration aids; some of the same force could, as later decided, carry two warheads without penaids. This course would avoid the delay of up to two years and other drawbacks (such as decreased mobility) attendant on a substantially higher payload weight.

2. SDI

a) The ABM Treaty has been a means of enhancing stability. It should be preserved until and unless very strong reasons appear for changing it, e.g.: if Soviet preemptive capability appears likely to become such that a U.S. nuclear strategy of deterrence by the threat of retaliation, holding at risk what the Soviet leadership values, could not be maintained under the Treaty; if the Soviets were to break out (or creep out) of the Treaty; or if an offense-defense mix could be demonstrated to provide significantly enhanced stability.

b) It might at some future time be necessary for the U.S. to adopt some form of strategic defense to maintain the credibility of U.S. nuclear strategy. A program of research and technological development (not systems development), applicable to defense against ballistic missiles and airbreathers (aircraft and cruise missiles), should therefore be pursued:

i) to explore the technologies and potential designs applicable to strategic defense.

ii) to judge the cost-exchange ratios for defending various targets to various levels of survival in the face of a responsive threat including countermeasures, to determine the vulnerability of the defenses to direct attack, and to analyze the stability of various configurations of defensive and offensive deployments.

iii) to deter and if necessary to respond to a Soviet ABM breakout.

iv) to preserve possible options for active defense of selected retaliatory forces and strategic C^3, for limited population defense against certain small attacks, or otherwise to complicate Soviet strategy.

c) Deterrence of nuclear attack by maintaining survivable offensive forces and C^3 will remain the only feasible strategy for the foreseeable future. A transition to greater dependence on active defense for the protection of retaliatory forces could probably be implemented by the end of the century, but its desirability is not clear. A significant degree of protection of population, if feasible at all in the face of countermeasures, would be decades away.

Given these considerations:

d) the U.S. should

i) Abide by the historical ("restrictive") interpretation of the Anti-Ballistic Missile (ABM) Treaty.

ii) Protect fully, in any negotiations, the ability of the U.S. to do research (as described in 2 b) above) under the Treaty.

iii) Continue to evaluate SDI by the criteria of cost-exchange ratios at the margin, degree of vulnerability of the defensive system to direct attack, effect on stability, and impact on the strategic balance. The cost and value of SDI must also be weighed against those of other military programs for both strategic and general purpose forces.

e) The SDI research program should:

i) Avoid spectaculars carried out for their own sake;

ii) Emphasize ground-based terminal defense of mobile or hard points, ground-based and space-based sensors, and advanced directed energy weapons (such as ground-based free-electron lasers and space-based chemical lasers). Insofar as space-based kinetic-energy weapons appear to be vulnerable to straightforward countermeasures, that approach should be deemphasized.

iii) Proceed at a measured technological pace, increasing annual TOA from the FY 1986 level of $2.76 billion (in the Department of Defense -- the Department of Energy program contains separate funding of $300 million) over the next two or three years at a rate consistent with efficient progress; we judge that to be on the order of 10 percent per year.

iv) Divert some of the funds thus made available to high-technology conventional force initiatives in order to reduce the risk that the rapid rise in SDI R&D funding may have starved U.S. conventional forces of the technological edge they need to offset Soviet advantages in conventional force size.

v) Not make any decision on full-scale engineering development of a multi-tier SDI system before the early 1990s at the earliest.

f) The U.S. should continue active efforts to enforce Soviet compliance with the ABM Treaty.

g) In maintaining SDI options, the U.S. should:

i) Seek constraints on antisatellite systems (ASAT), to avoid their becoming a loophole for evasion of the ABM Treaty (see 4 b)).

ii) Examine an anti-tactical ballistic missile system (ATBM) as a possible way to protect NATO forces and C^3 from a Soviet non-nuclear attack. Such a system will be feasible politically only if governments and publics can be convinced that it is more effective than other methods (such as dispersal, hardening, and mobility) by themselves, and also affordable. If so, and ATBM is pursued, it will be important to define constraints that will prevent it from becoming a loophole or an easy route for Soviet creepout from the ABM Treaty.

iii) Keep technologies open but avoid foreclosing arms control options. At present it appears that this is best done by being very cautious about space-based weapons systems because: their effects might be destabilizing; strategic offensive forces can be defended without space-based weapons; and in a possible transition to heavier reliance on defensive systems, space-based defensive systems are likely to be appropriate at a later time than ground-based ones.

3. SALT II. The general U.S. policy should be to continue not to undercut the Treaty, especially its numerical limits. Response to Soviet transgressions should be first to pursue the Standing Consultative Commission (SCC) route. Where the results of that approach are unsatisfactory, the adequacy of programmed U.S. forces should be reviewed in the light of such Soviet actions. In deciding on U.S. responses, whether political in nature or in the form of a change in strategic force structure, both the likely effect on future Soviet compliance and the range of possible Soviet political or force structure response should be considered. U.S. force structure responses to perceived Soviet noncompliance should be measured, and should be such as on balance to enhance the U.S. security position. They should generally fall within the SALT II limits, and could represent either an acceleration of planned programs or programs that the U.S. might not otherwise have done.

a) Concerns about Soviet violations or evasions of the ABM Treaty that do not significantly change the U.S. retaliatory capability should be met with U.S. offensive force changes that do not undercut SALT II, including a more vigorous penetration aids program.

b) The appropriate U.S. action in the face of Soviet SS-25 deployment is Midgetman development and subsequent deployment in the early 1990s, even though SALT II in its present form would not allow Midgetman deployment. Soviet SS-25 behavior is a further basis for proceeding with Midgetman, which we would wish to do in any event.

c) The SCC should be employed to pursue concerns about telemetry encryption (one interpretation that should be pressed is a limitation to the encryption level that prevailed when SALT II was signed), launcher numbers, and other compliance issues.

d) To preserve a response option if the Soviets continue to deploy additional (and new) ICBMs, the U.S. should keep the M-X line open.

e) The U.S. should dismantle Poseidon boats by cutting out missile compartments, as needed to remain within SALT II restrictions as Trident submarines and ALCM-equipped heavy bombers are deployed. The boats themselves should be preserved for possible future decision on conversion to other uses.

4. Arms Control

a) The U.S. should be prepared to accept mutual constraints against testing of kinetic-energy weapons or directed energy weapons in space, and of such weapons (on the ground or in space) directed at targets in orbit, for a period of up to 10 years as part of a meaningful agreement on strategic offensive force reductions. A four or five year notice for withdrawal on "supreme national interest" grounds could replace the present six-month notice period in the ABM Treaty. (It should be noted that violation by the other side voids the treaty in any event -- but the case would have to be a very convincing one. Observance of the extended withdrawal period could also be linked to compliance with SOF treaties).

An agreement on strategic offensive forces will have to cover bombers (and their cruise missiles) as well as ballistic missiles; formulas for equivalence of warheads and payloads of ballistic and air-breathing systems can be defined. Submarine-launched cruise missiles (SLCMs) will also have to be dealt with. The U.S. and U.S.S.R. would then be limited to common ceilings on the numbers of warhead equivalents and on payload equivalents, at about 50 percent of the present (higher of the U.S. or Soviet) numbers. A common ceiling on payload equivalents can be approached either directly or through certain warhead or other subceilings. Since U.S. deployments for active defense of its strategic offensive forces (for example ICBMs) are limited under the ABM Treaty, and would presumably also be limited under any modification of it, there should be limits on the Soviet forces that threaten them. To that end, a sublimit of 3000 to 4000 ICBM warheads would be appropriate. Mobile ICBM deployment should be permitted consistent with adequate verification of numbers.

b) Dedicated ASAT operational capabilities should be limited to their present level on both sides. This includes existing U.S. MHV/F-15 and Soviet coorbital SL-8. Development of ground-based laser ASATs should be allowed (to allow SDI technology development, and insurance in the form of development of defense suppressors against a Soviet space-based SDI breakout) but not testing against targets or mirrors in space.

c) The U.S. and U.S.S.R. should have equal rights to a reduced number of INF: equal numbers in Europe; U.S. rights to a number (in U.S. or Asia) equal to Soviet numbers in Asia; British and French systems neither frozen nor included in totals; U.S. may choose not to exercise rights fully.

d) The U.S. should ratify the Threshold Test Ban and work for a reduction of the Threshold to lower values as verification improves; a level on the order of 10KT is a reasonable near-term target. We should continue negotiation on the possibility of a Comprehensive Test Ban.

REASONABLE ANNUAL GROWTH IN SDI BUDGET

Chairman STENNIS. I think we ought to adopt a time limit, gentlemen. And if there's no objection, we'll make it ten minutes chargeable to the person.

All right, and charge me with whatever I use.

Doctor Brown, since last year, your estimates of what represents reasonable annual growth in the SDI budget have been reduced progressively from 25 percent to 15–20 percent to about 10 percent.

Why have your estimates been reduced over time, and what do you now consider as a reasonable rough guideline which Congress should consider for average annual real growth in fiscal year 1988 and fiscal year 1989?

The Administration request, excluding the $500 million in the fiscal year 1987 supplemental, represents about 56 percent real growth in fiscal year 1988 and 16 percent real growth in fiscal year 1989.

Now, not that this is an overwhelming fact by any means, but I have voted for the lesser amount that's been presented after we've had these hearings in former years, and I did not want to just stop the matter.

At the same time, it seemed to me like a very large sum of money in a very short time, over $5 billion requested, for those purposes, for 12-months' use.

So I voted for the smaller figure. I just say that by way of general explanation. I'm not fishing for anything that supports me, or indicating what I will support now.

So you go ahead with that answer.

Dr. BROWN. Mr. Chairman, the exact amount is always a matter of judgment, and as you know better than I, is also in the legislative process a matter for negotiation. It may be traded off for something that has, on the surface, at least, very little connection with the specific program at hand.

At various times I've said 20 percent, 15 percent, 10 percent. In the case of the paper you referred to, the August 1 paper, there were five people who subscribed to that, and there was a certain amount of negotiation on what that number should be.

Some of us may have felt the numbers should have been closer to zero growth, and others, that maybe it should be 15 or 20 percent growth. And so we came out with 10.

That's a process not unknown to you as Senators.

The main point is that 10 percent or 15 percent is a gradual growth, and that's the kind of thing that I think could make sense, to allow new ideas to be explored.

Fifty-six percent, going from $3.5 billion to $5.8 billion, is characteristic of a completely different kind of decision, a decision that something of this sort is going to be developed on a crash basis and deployed, and I just can't support that at all.

And so far at least, the Congress has also been unwilling to support it.

There is one other reason why an evolution from 20 to 15 to 10 percent is appropriate: the fiscal situation has evolved over the past couple of years in a not-very-attractive fashion. And if the President and the Congress are going to face up to the budget deficit, that is going to have its effect on every program, including SDI.

It makes the tradeoffs between SDI funding and other defense program funding more stringent.

For SDI to grow at 20 percent or at 15 percent, at a time when the total defense budget is growing at 3 percent a year is one thing, and probably justified.

If the total defense program is flat, or actually decreasing in real terms, that suggests that SDI should grow more slowly as well.

Chairman STENNIS. Thank you, sir.

SPACE-BASED KINETIC KILL VEHICLE DEFENSE SYSTEM

Now, Doctor, you indicate the Soviets can counter a space-based kinetic kill vehicle defense system in a fairly easy and straightforward manner.

SDI's program director, General Abrahamson, apparently disagrees with you on that point.

On what do you base your assessment, and will it really be that easy for the Soviets to neutralize the early deployment space defenses being contemplated by the administration?

Dr. BROWN. I based my judgment, Mr. Chairman, on an examination, not in as much detail as General Abrahamson is in a position to do, of the SDI program, and on my own experience on the development of strategic offense forces of the kind that would counter an early deployment of SDI using space-based kinetic kill vehicles, and a couple of ground-based layers.

The ground based layers, as is well known, have deficiencies in being able to intercept decoyed strategic attacks. There is, as yet, no good way to do midcourse or high exoatmospheric discrimination.

As warheads come in with a lot of decoys, you can tell them apart by the filtering effect of the atmosphere, but only after they come down so far that if they explode there, they destroy cities and populations.

In other words, you can probably intercept them at 10-, 20-, 30,000 feet by having discriminated them, but that's too late; too late to defend cities.

It's all right for defending hardened silos with ICBMs in them, but it's no good for defending cities.

So that terminal defense by itself is not in a position to provide population defense. That is why the developers and designers, proponents of a strategic defense against ballistic missiles correctly say you've got to do something about boost phase, and intercept many of the missiles during their boost phase, and some more during midcourse.

Midcourse discrimination has not gotten anywhere over the past few years.

So you're down to boost phase. And the question is, can an offensive force be modified and changed so as to be able to defeat the attempts to intercept the booster before it stops burning and releases its warheads, or can the offense do something that makes that very difficult?

The answer is that the offense may not have an easy time in deploying fast-burn boosters, for example, but they will have an easier time doing that than the defense will have in putting up the space-based layer to intercept it.

As I indicated in my prepared statement, 6 or 7 years is an absurd time to think about deploying something as complicated as a space-based system. You're talking about putting a million pounds in orbit, at a time when typically we're putting—every year—we now put into orbit perhaps, oh, a tenth of that.

Actually, this year, we'll put in much less than a tenth.

It does take quite a bit of work to build a fast-burn booster. But it's already been demonstrated that in going from liquid fuel rockets to Minuteman, we've shortened the burn time.

Minuteman to MX shortens it some more. Another generation could give you a fast-burn booster. And I have no doubt that the Soviets are now at least working on this.

They may not have included them in their plans for their next generation of ICBMs. But if the US goes ahead with a space-based kinetic kill vehicle program, they certainly will do so, and I believe that they can do so at a time and at a cost and with a certainty much to their advantage, as compared to what those factors are for U.S. deployment of kinetic kill vehicles.

That's just one way to beat the system. But I think everyone agrees that it will beat the system. It will beat that layer of SDI, the boost phase intercept.

The only argument is about which is more difficult and which costs more and which takes longer, the countermeasures, the fast-burn booster, or the space-based system.

It's only if you assume that the Soviets don't do what they would have to do and can do that you can arrive at a conclusion favorable to early deployment of a kinetic kill vehicle SDI layer.

Chairman STENNIS. All right, thank you, Doctor. I judge my time has expired.

Now I am going to call on Senator Stevens of Alaska.

PREPARED STATEMENT OF SENATOR D'AMATO

Senator STEVENS. Thank you, Mr. Chairman. Senator D'Amato was not here at the opening, and he wanted to insert a statement in the record, if that is all right.

Senator D'AMATO. Mr. Chairman, I request permission.

Chairman STENNIS. You just want to put a statement in the record?

Senator D'AMATO. Yes, Mr. Chairman.

Chairman STENNIS. Without objection, the Senator from New York's statement will be placed in the record.

[The statement follows:]

PREPARED STATEMENT OF HON. ALFONSE D'AMATO

U.S. SENATOR FROM NEW YORK

Mr. Chairman, I welcome to this committee former Defense Secretary Harold Brown and Dr. George Miller, Associate Director for Defense Systems at Lawrence Livermore National Laboratory, and I look forward to their testimony.

The administration has requested an increase from $3.2 billion for this fiscal year to $5.2 billion in fiscal year 1988 and $6.2 billion in fiscal year 1989, as well as a $500 million supplemental request for this fiscal year. This committee will be making difficult decisions on funding levels for SDI over the next few months, and I am glad to have the recommendations of our distinguished witnesses.

I am concerned over reports that the Soviet Union is spending 15 times what the United States spends on strategic defense. Although we hold a technological advantage, I fear such aggressive Soviet spending could close this gap in the near future. The Soviet Union has the world's only operational antisatellite capability, as well as the only operational antiballistic missile system. The U.S.S.R. is actively developing and modernizing its defenses, including air defense and surface-to-air missiles. The Soviet Union now has a clear advantage in strategic defenses that offers Moscow an increasing ability—and, perhaps, the temptation—to deal with the retaliatory forces of our nation and those of our allies.

SDI continues to be an intensive research program focused on advanced defensive technologies with the goal of the eventual elimination of the threat posed by nuclear missiles, and with the aim of lessening the probability of nuclear war. By devaluing Soviet first-strike weapons—the land-based, highly accurate ICBM's—deterrence can be preserved.

The President recently issued a report citing Soviet noncompliance with arms control agreements. According to the report, the installation of the Krasnoyarsk radar is an outright violation. In addition, The Soviets' concurrent operation of air-defense systems that may have ABM capabilities, are probable violations. One question we must ask ourselves while we ponder the various interpretations of the ABM Treaty is, "Are we unilaterally observing this important treaty?"

Even despite this present threat, the issue of proceeding to deployment of an actual ballistic missile defense system will not arise for several years, and only after the necessary preliminary research has determined that such systems are both feasible and cost-effective.

Our nation needs the Strategic Defense Initiative. Research must continue as planned and with proper funding.

Thank you, Mr. Chairman.

ABM TREATIES

Chairman STENNIS. Senator Stevens.

Senator STEVENS. Let me join in welcoming Dr. Brown, a former member of the negotiating team as a matter of fact.

As I've read through the negotiating record, I do find your comments and your papers most interesting, Dr. Brown.

Let me just ask you this. I have, in the course of my recent thorough review, gone through several treaties, including a book called The Treaty Trap.

I'm sure you're familiar with that, and the line of those who say that a democracy makes a mistake by entering treaties in the beginning, because totalitarian governments don't follow them.

Do you think the ABM Treaty has actually been a success as far as the United States is concerned?

Dr. BROWN. I believe it has been in the net, on balance, an advantage to U.S. national security. The reason I think that is that it has avoided large and, in my judgment, probably destabilizing expenditures by the two sides on deployment of antiballistic missile systems that in fact would not have worked, but which would have excited more concern on each side, and an expansion of offensive forces as well.

In other words, an attempt to supercede deterrence by active defense would at best have left the situation one of still mutual deterrence, but with a worse political situation and higher apprehensions about nuclear war.

Now, that's a judgment; others don't share it.

Senator STEVENS. At the time, the Soviets wanted to proceed with a defense system, and the United States felt that we could not afford it, is my judgment of the record I've seen.

Dr. BROWN. That's not a bad estimate.

Senator STEVENS. The Soviets went back to the Soviet Union and said, we agreed to limit ground-based systems and their future development, but there is no limitation in this treaty on our future use of any kind of unknown principles, and I'm afraid I'm constrained not to read some of the actual statements that were made by one of the Soviet negotiators at the time, which said that they would not enter into any agreement in effect that would try to ban unknown systems based on new physical principles.

You remember those dialogues in those records which we can't talk about, which I think is unfortunate. But it reminds me a little bit of the time I went home to Alaska and said that Congress had just passed an act that I voted against, but we really got 85 percent of what we wanted.

And the opponents went to New York and said, Congress just passed, and the President signed, an act which destroyed the Alaskans' ability to develop Alaska.

Both sides saw in that bill what they wanted, and it looks to me like ABM is about the same thing. What do you say about that? The Soviets at the time thought they had not given up the future as far as exotic research, isn't that right?

Dr. BROWN. Well, there is the now frequently quoted Grechko statement, which says that—statement of Marshall Grechko, then the Minister of Defense in the Soviet Union—which said that deployments will be sharply limited, but there's no limit on conducting research and experimental work directed toward solving the problem of defending the country from nuclear missile strikes.

Note that the words are research and experimental work; they are not development and testing.

But the fact is, at the end of those negotiations, in my judgment, both sides were thinking about exotic systems based on the ground. And on those developments and testing, neither side had any intention of being limited or precluded.

On space-based, air-based, ground-mobile, sea-based, the article of the treaty was, in my judgment, applicable.

Now I would say, having looked at the record, but perhaps not in the detail that you have, that there is some ambiguity. And indeed, it's always the case that the two sides in a negotiation go away from it, even when it's been concluded, expecting to get different things out of it.

That doesn't mean that they need disagree on whether a given action is allowed or not allowed.

VALUE OF SDI UNDER LIMITED OFFENSIVE CAPABILITY

Senator STEVENS. Let me turn the tables around. I have great respect for your work at Livermore, what you've done as Secretary, and the fact that you're continuing to advise the country and the Congress in the area of defense.

And your contribution has been significant. I've said that before, Harold, and I really mean it.

But those of us who are so subjective and pragmatic sometimes don't allow our dreams to materialize because we look at them as dreams.

Let's just assume for a minute that we do get a treaty that really is in a series of phases and requires the Soviets to stand down a lot of their weapons and us to stand down ours, and that happens; it leads to a second phase, which is a further reduction in nuclear weapons; and then another phase, which is a real reduction in nuclear weapons, both sides maintaining a sufficiency for defense, but under new arrangements.

We're not talking about thousands of warheads now. We're talking about hundreds. Maybe not even a hundred.

As you know, our proposal is for 100 warheads, 33 vehicles as far as INF now—that's what's being debated over there now.

But let's just assume we get to the point where we've got 100 warheads on either side; increased technology to deliver them, no question about that; maybe even a single warhead system.

How important is SDI then? With a limited offensive capability, how important is SDI to assure against cheating in the future?

Dr. BROWN. In the limit of zero nuclear warheads, ballistic missile or air breathing, bomber and cruise missile, then defenses would probably work very well indeed.

Senator STEVENS. We wouldn't need them then.

Dr. BROWN. That's right.

Senator STEVENS. I am postulating a serious threat out there, but not an unlimited threat.

Dr. BROWN. I think that is an interesting scenario to look at. And there are two points I would like to make about it.

One is, how it looks when you get there, and the second is, what happens on the way there.

Let's assume that somehow—and leave aside the question of how you get there for the moment—that there are a few hundred warheads on each side, and they're a mixture of ballistic missile and bomber warheads. You've got air defenses on both sides. You've got ballistic missile defenses on both sides.

Now let's say—again, this is all hypothetical, it's a dream of the kind you're talking about—but let's look at the dream and see whether it's a nightmare or a pleasant dream.

Supposing that your best estimate of what your system can do is take 300 warheads on the other side and intercept 95 percent of them, so that even if there's an all-out attack, only 15 warheads get through. And let's say they're directed against cities, because under those circumstances, that's what they might be used against, since a 95 percent attrition of the warheads directed against military targets is a very, very good defense indeed, and makes it not a very good idea to attack the military targets.

Fifteen warheads on the United States. Enormous destruction. But the U.S. survives. Interesting dream. But how confident can you be in that 5 percent, even on your own side?

Senator STEVENS. Wait a minute. I was hopeful you would go out beyond the two superpowers. Remember, in terms of proliferation of nuclear weapons, we thought we had the answer.

But nuclear weapons continue to proliferate. What about the potential from the parties that are not parties to the superpower agreement?

Dr. BROWN. Let me deal with that in just a minute.

Senator STEVENS. Isn't that what SDI has a role for?

Dr. BROWN. It changes from month to month, from day to day, sometimes even from minute to minute in the same discussion.

At the moment, we're worrying about the Soviet Union. I'll get to the other powers in a minute. I think it's a legitimate question, but you have to ask first about the Soviet Union.

Senator STEVENS. My time has expired, but I will ask the Chairman if he will let you answer.

Dr. BROWN. OK, and I will try to——

Senator STEVENS. I think we should dare to dream.

Dr. BROWN. And I will try to answer in a brief way.

Chairman STENNIS. All right, just make a brief answer. If you want to make it longer later, all right.

Dr. BROWN. I'll do it briefly now, Mr. Chairman.

We won't know whether it's 5 percent getting through, or 25 percent getting through, or 50 percent getting through. And if 50 percent get through, you're not talking about 15; you're talking about 150 warheads on U.S. cities; and that's destruction of the country.

Moreover, our estimate of what the other side is able to do in the way of defense will be very uncertain. What happens if they have a defense, we have a defense, they'll be different. We think theirs is much better than ours, or they think ours is much better than theirs.

Maybe that's good, but I think it's destabilizing.

On the third country question, we can't intercept light planes carrying drugs across the border. A third country, a Libya, is much less likely to use intercontinental missiles than it is to use suitcases.

So I think that the marginal contribution to defense against such things by SDI is small, and the price, hundreds of billions of dollars, is high.

I don't say, don't dream. But find out what your dreams do for you and what they cost you, before you decide to deploy something.

Chairman STENNIS. You will have a chance later to give a further answer.

Senator Johnston, that brings us to you.

Senator SASSER. Senator Johnston, would you yield for just a minute?

Mr. Chairman, I ask unanimous consent that questions propounded by Senator Robert Byrd be included in the record.

Chairman STENNIS. Without objection, the questions will be included in the record.

Senator KASTEN. Bennett, could you yield for 10 seconds, Mr. Chairman? I also have some questions I would like to submit for the record, and I thank you and thank the Senator.

Chairman STENNIS. All right, Senator Kasten.

FAST BURN

Senator STEVENS. You get paid by the hour, Harold?

Dr. BROWN. I understand and I do not object to this procedure. I am used to it. The difference is, I have nobody else to answer the questions now, whereas all of you gentlemen have a lot of people to help you prepare them.

Chairman STENNIS. All right. Senator Johnston.

Senator JOHNSTON. Dr. Brown, thank you very much for your testimony. I think you used the right word when you said it is absurd to think that you can deploy this thing in the 1993, 1994 time frame at anything like the cost they are talking about. I mean, at any cost. I have three questions to ask with respect to the fast-burn, and I hope you can answer them fairly fast, because I have got some other questions, too.

First of all, the fast burn, if in place in the Soviet Union, defeats catastrophically the space-based kinetic kill SDI, does it not?

Dr. BROWN. That is right. If there is very little burning outside of the atmosphere, then there is almost no time for the kinetic kill vehicles to get to it before the burn stops, and that means that the kinetic kill vehicles have got be so densely distributed in order to get there in time that the cost of the defensive system goes up exponentially and it just does not work.

Senator JOHNSTON. If they get there in time at all?

Dr. BROWN. That is right.

Senator JOHNSTON. Second, what would you imagine could be ready first? Let us say that we have a meeting over there with President Reagan and he says, let us go for SBKKV, let us fund it, it is a new Manhattan Project, let us deploy it, and the Soviets say, well, they are going to deploy this, let us go to fast burn. Who would be able to get there first?

Dr. BROWN. I would much rather be given a job of getting the fast-burn booster done than I would the SDI KKV in the boost phase. We know how to do a fast burn. It has problems. It would be expensive, but it is much more like what exists than the boost phase kinetic kill vehicle intercept is.

Senator JOHNSTON. Actually, we knew that 27 years ago. I have a quotation here—from 27 years ago that said, "This trend toward reduced burning times is characteristic of the U.S. research and development." And that was 27 years ago. Surely the Soviets have the technology now. Obviously they do not have it deployed in their rockets, but there is no reason to doubt they have the technology now, is there?

Dr. BROWN. The Soviets are now deploying solid propellant ICBM's which are much faster burn than liquid propellant. A steady evolution of rapid acceleration of that technology would give them a fast-burn booster in the early to mid-1990's time frame in my judgment if they decided they needed to do it.

Senator JOHNSTON. All right. Dr. Brown, according to your testimony then, fast burn defeats catastrophically SBKKV. Second, the Soviets, if they put their mind to it to the same extent that we put our mind to it, would get there first. They would have their fast-burn rockets in place before we had SDI in place. And a third question is, who spends the most money to achieve the goal? In other words, is it cheaper to put SDI, that is, the space-based kinetic kill, in operation than it is for the Soviets to go to fast burn?

Dr. BROWN. The fast-burn booster would cost probably as much as any other new ICBM system.

Senator JOHNSTON. We are talking about $30 billion?

Dr. BROWN. Thirty billion dollars, say, and of course you do not have to do it with the whole force. You have to do it with a part of the force, because, if the fast-burn booster can be used to penetrate, it can also be used to destroy the defensive system, and if you destroy the defensive system, or punch a hole in it, then all the rest of the force can get through. The KKV layer by itself has been estimated officially to cost on the order of $50 billion. There is also an estimate by the Marshall Institute of about the same thing. There are other estimates which I think are much more realistic that are about $300 or $400 billion, and I think those are probably about right. It is harder to say what the SDI costs than what the fast burn costs because it is much less well defined even now, and so the uncertainty is much greater, but I would say several hundred billion dollars at least.

So you are talking about a factor of five or ten difference in favor of the fast-burn booster.

Senator JOHNSTON. Well, then, I guess the final conclusion answers itself. It would be absurd for us to pursue a KKV system at this time, would it not?

Dr. BROWN. I think it would be a mistake. The absurdity has to do with the time scale, Senator.

FOLLOW-ON DEVELOPMENT

Senator JOHNSTON. Finally, they talk about—there is a phrase "follow-on development," meaning the first phase SBKKV followed by a second phase, I guess, some kind of beam weapon, whether it is ex-ray laser or eximer laser or free electron rays or whatever it is. Now, is it not really incorrect to talk about follow-on or stairsteps as if the second technology is built upon the first, because these machines are not like shotgun shells that you can just take out the SBKKV and put in a beam weapon, are they?

Dr. BROWN. The architectures tend to be rather different. There is some overlap. You would still need command and control satellites. You would still need complicated software. It would have to be different. You still need detection systems. And much of that would be the same or could be the same, but the interceptors would be based at one altitude and beam weapons at a different altitude. The numbers would be very different. One talks about thousands of satellites each carrying ten KKVs. One talks about maybe tens of satellites at a higher altitude carrying beam weapons. Those are completely different, and that would have an effect on the overall architecture.

Senator JOHNSTON. Dr. Brown, are not the two actually at war with one another in the sense that, given limited resources, if we devote what you say is a realistic estimate of $200, $300, $400 billion toward SBKKV systems, does that not take away from the possibility of developing a beam weapons system at an earlier time?

Dr. BROWN. Well, it is, of course, almost a cliche to say that everything competes with everything else for funds, but when you are talking about hundreds of billions of dollars it becomes more than a cliche. It is a fact of life that if you start down one path, you are unlikely to reverse paths a few years later successfully, and indeed even during the development program there is competition which, as I understand it, has already started to take funds away from the more advanced programs in order to fund the near-term development and possible deployment of the kinetic kill vehicle.

HEAVY-LIFT SHUTTLE COST PER POUND

Senator JOHNSTON. Dr. Brown, you say that we certainly need a heavy-lift vehicle because we would need to put at least a million pounds into orbit, and that we are doing a less than a tenth of that this year. Now, the current cost in the shuttle is about $5,000 a pound, is it not?

Dr. BROWN. Yes, three to five. I think last time I testified I said three. Five may be more realistic.

Senator JOHNSTON. I think the shuttle cost is five and maybe without the shuttle it is a little less than that. But a million pounds in orbit, that is an annual need to orbit, is it not?

Dr. BROWN. Roughly, yes.

Senator JOHNSTON. So you are talking about orbital costs alone if you are talking about a million pounds in orbit, and the SDI puts out requirements that go from a little more than a half million kilograms up through 2.5 million kilograms.

Dr. BROWN. Which is five million pounds, and that would amount to $25 billion a year just for the booster costs.

Senator JOHNSTON. I will follow up later. I think my time has expired. Thank you very much, Dr. Brown.

Chairman STENNIS. Senator Sasser, that brings us to you, sir.

Senator SASSER. Thank you very much, Mr. Chairman.

SDI DEPLOYMENT

Dr. Brown, the Secretary of Defense, Mr. Weinberger, has indicated that we would have initial deployment of SDI by 1993. I take it that that you disagree most emphatically with the Secretary's assesssment.

Dr. BROWN. Yes, my judgment is different. I think that it will take quite a bit longer if you go ahead with this program to begin to deploy SDI in space than it took to do the B1 or than it would take to do an aircraft carrier, which is the 6- or 7-year period.

Senator SASSER. Of course, we have got the B1 deployed, but it is not doing us much good at the present time. And that is a much less complex system than the SDI system would be. In your view, Dr. Brown, how long would it take us to deploy a space-based SDI system?

Dr. BROWN. Well, my own judgment, Senator Sasser, was expressed in an article which I entered into the record, I guess, last year, and what I said then was that you could begin to deploy space-based systems probably about 1997 or 1998, and it would take you 7 or 8 years to complete that deployment if you were dealing with kinetic energy weapons, which I have just said are too easily defeated for that to make sense to me as the first thing to deploy.

Senator SASSER. Let me just stop you there. Now, you were a delegate, as I recall, to the negotiations which led up to the ABM treaty. Is that correct?

Dr. BROWN. Yes, sir.

Senator SASSER. Can we, under the broad interpretation of the antiballistic missile treaty, realistically test kinetic kill vehicles in your judgment?

Dr. BROWN. Well, you can do, I think, subcomponent tests. You can do element tests. But even under the broad interpretation, as I read the broad interpretation you would be precluded from testing systems that rely on other than new physical principles, and I do not regard hitting something with a rock as a new physical principle. I think that the kinetic energy weapon is an interceptor. It is an interceptor from space, not from the ground, but it is an interceptor, and so I leave the legal arguments to the lawyers. I can speak only as a layman——

Senator SASSER. Do not make the mistake of leaving legal arguments to lawyers, Dr. Brown. I say that as a lawyer.

Dr. BROWN. I did not say I would leave the judgments to the lawyers, Senator Sasser. I just said I would leave the legal arguments to them. My judgment would be that systems development and testing would be precluded. It is, of course, even more true for the other more exotic space-based chemical laser, neutral particle beam, free electron laser, but those are farther away, and when I said 1997 or 1998 I was talking about kinetic energy weapons. Particle beam, chemical lasers, I said you could begin in about the year 2000 to deploy ground-based systems with mirrors in space, maybe some time between 2000 and 2005. So those are a long, long time away. And who knows they will work out?

Senator SASSER. But it is your judgment then that we could not even realistically test the kinetic vehicles without breaking out of the ABM treaty.

Dr. BROWN. Well, when I say you could not realistically test, I am not saying you cannot find out quite a lot more about it with experiments that I would consider compatible with the treaty. I am just saying that you cannot have component or systems testing, and that would have to be more closely defined. I think that you could do some experiments, some experiments in space without violating even my version of the narrow interpretation of the treaty.

COST ESTIMATES OF FAST-BURN BOOSTERS

Senator SASSER. Did you give Senator Johnston a moment ago your estimate of the cost of fast-burn boosters or the number of fast-burn boosters that would be necessary to essentially defeat a strategic defense system?

Dr. BROWN. What I said was that it would cost on the order of $30 billion to replace some component of the Soviet ICBM force, the SS-19 force, say, with fast-burn boosters, and that that would defeat a KKV space-based boost phase intercept layer and could be done more quickly. As I say, I do not think you could start deploying a KKV layer probably until about 1998.

Senator SASSER. Well, I note in the December 31, 1986, issue of National Review that the author of an article in that magazine, Mr. Simon Warden, claims that "Fast-burn boosters would cost about $100 million per warhead." Still quoting, "If the Soviets chose to replace their entire arsenal with fast-burn boosters it would take them 20 years at a cost of $1 trillion," so that is just not right, is it?

Dr. BROWN. I would disagree with what Colonel Warden says about that. I think that his judgment on that is probably colored by his view of SDI, just as is probably the case for all of us. I think what I would like to do is just set aside SDI for the moment and say, supposing you had to make a fast-burn booster, what would it cost, and it would be about the same as other systems. I think what is happening is, he is putting a requirement on the fast-burn booster that goes far beyond what would really be necessary. There is some question about how high you would have to burn out or how low you would have to burn out in order to defeat the KKV interceptor system. He is far too optimistic about what the KKV can do and far too pessimistic about what a fast-burn booster would have to do.

Part of the point is, if you want to get into a little bit more esoteric discussion, is that a booster has to be able to release, cannot release its multiple RVs until it has gotten out of the atmosphere, and that gives the defense a little bit more time to see the booster than if you did not have to release multiple RVs. On the other hand, if you are going after the defensive system you do not need multiple RVs. What you can do is, you can just burn out rather low, not have to release any other RVs, and then go after the defensive system. So I think that that estimate is a highly colored estimate, as it does not correspond to what relatively neutral people, and there are some neutral people on these issues, come out with as their answer for the cost of fast-burn boosters.

Senator SASSER. Thank you, Dr. Brown.

Chairman STENNIS. We are glad to have Senator McClure. I got word some time ago he was headed this way and wanted to come. I am glad you got here.

Senator MCCLURE. Thank you very much. I came to listen, and I do not have any questions of this witness at this time.

Chairman STENNIS. All right. Members of the committee, I am going to call on you. What should be the pleasure of the committee? I see the light is burning up there. Anyway, we have Dr. Miller with us here. He is a highly competent man, a specialist in this field, here today to testify, and we are certainly going to hear you, Doctor. It is just a question of when.

Senator JOHNSTON. Mr. Chairman, I would like to put some questions in the record. While I have more questions, I would like to hear Dr. Miller, too, so I will just put those written questions in.

Chairman STENNIS. We are not going to close now anyway. I just wanted to see where we are. I just wonder if it is not agreeable for us to continue on here if these gentlemen can, say, for another hour. Is that agreeable to the membership now? We will take another hour anyway here.

Dr. BROWN. Mr. Chairman, I will have to leave at about 12:30, but you will want to get to Dr. Miller anyway.

Chairman STENNIS. I interpreted your nod there that you could stay until 1:00 o'clock. Dr. Miller, what is your situation? Can you stay to do your testimony now? If you would rather have a recess, we can come back this afternoon.

Dr. MILLER. I am perfectly willing to stay now. My only time scale is a late afternoon plane.

Chairman STENNIS. Well, my feeling about it is, let us proceed and I will see what develops. We will call on you, Senator Johnston.

DEFENSE OF SBKKV

Senator JOHNSTON. Mr. Chairman, I will go ahead. I have got some other questions but I will ask those in writing. I want to ask about how well you can defend the SBKKV, and I think the answer is, you cannot, but I will put that in writing.

Dr. BROWN. I think I would prefer, Mr. Chairman, to leave if possible.

Chairman STENNIS. You may. We want to especially thank you for coming here. Your testimony is interesting and valuable and will be used. I can assure you there are many of us that will ponder it, and it is very fine to have you here again.

Dr. BROWN. Thank you.

LAWRENCE LIVERMORE NATIONAL LABORATORY

STATEMENT OF GEORGE H. MILLER, ASSOCIATE DIRECTOR, DEFENSE SYSTEMS PROGRAM, LAWRENCE LIVERMORE NATIONAL LABORATORY

INTRODUCTION OF GEORGE MILLER

Chairman STENNIS. Members of the committee, this is Dr. George Miller. As I have already said, he is well known for his effort and achievement and knowledge in this field. We appreciate your being here today, sir, and look forward to hearing your testimony.

All right. We are glad to have you, and we will let you open as you see fit with your statement.

Dr. MILLER. Thank you very much, Mr. Chairman. I am very pleased to be here and have the opportunity to speak on this important national issue. I would like to submit my statement for the record in its entirety, and I would like to just briefly summarize some of the major points that I made in there. Many of the points that I wish to make Secretary Brown has already touched upon, and I would like to provide some additional illumination on some of the points, hopefully in not so much technical detail that I obscure the major issues.

Chairman STENNIS. It will be welcome, whatever you do cover, and it is not a sin to be guilty of repetition of what someone else has said, because it takes a lot of jurors to make up a court, you know, a lot of witnesses to make it work.

Dr. MILLER. Thank you very much, sir.

Chairman STENNIS. So we are pleased to have you here, as I have said, and you just proceed now in your own way, and if we have any specific questions it will come a little bit later.

Tell us, we met yesterday, and we chatted quite briefly, but you are affiliated with whom, now?

Dr. MILLER. Yes, sir. I am Associate Director for Defense Systems at Lawrence Livermore National Laboratory. That is a Department of Energy National Laboratory. We have major programs in nuclear weapons and SDI.

Chairman STENNIS. All right. Proceed in your own way, please.

SUPPORT OF SDI RESEARCH PROGRAMS

Dr. MILLER. Thank you very much. I wanted to say to start off that I am an enthusiastic supporter for the need for a well-funded and stable effort in the Strategic Defense Initiative. I think it was entirely appropriate to establish this focused research program because of the significant technological developments that have taken place. As primarily a technologist rather than a policymaker, I am nevertheless very cautious and mindful of the many technological hurdles that we have yet to surpass.

MAJOR SDI TECHNOLOGIES

At Livermore we have two major SDI technology programs, one in the free electron laser, which is funded primarily by the Strategic Defense Initiative, and a nuclear pumped x ray laser which is funded primarily by the Department of Energy. The major comments that I would like to make this morning have to do with examining the broader implications of how technological development plays in SDI and SDI decision milestones.

FREE ELECTRON LASER

I would like to make just a few comments about the two Livermore technologies with the purpose of illustrating some of the important issues. The free electron laser is typical of a class of technologies which are still very early in their life history. They have enormous potential for providing tremendous capability, but they still have many physics issues as opposed to what I will call engineering issues which must be solved before we can say with demonstrated certainty that these technologies can provide the level of national requirements for defensive systems.

At Livermore we have developed and demonstrated at the component level viability of the free electron laser, but we are still continuing experiments on the basic accelerator and the laser that would be necessary to demonstrate to everyone that we can have this technology available. In addition, there are major issues associated with the ability of a ground-based system to propagate into the upper atmosphere. The time lines and the time scales for those more exotic technologies are longer than those for the more mature technologies like the space-based KKV.

X-RAY LASER

In my view it will be at least until the early 1990's, assuming proper funding, before we can make an informed decision on the viability of these technologies. We are very excited about the prospects of these technologies, but I think it is appropriate for the country to demand demonstration from us. The x-ray laser is another example. I think it is a useful example in the sense that the x-ray laser is a nuclear-pumped system, and the goal of SDI is a nonnuclear system. The original Fletcher study in 1983 noted that a nuclear pumped x-ray laser in the hands of the Soviet Union could make the survivability of U.S. space-based assets a very difficult prospect. It is for this reason that they suggested the need to provide early data on whether or not an x-ray laser is a feasible weapon as opposed to a paper design.

I think it is important to understand that the character of the strategic defense organization and its program has been to vigorously pursue knowledge of the full spectrum of ideas. They are very supportive of the need to very well define the threat of an x-ray laser or other potential countermeasures, and so it is to their credit that they are looking not only at pushing SDI, but looking at what might be a counter to SDI.

ANALYSIS OF TECHNOLOGIES INTERPLAY

In addition to these two major technology programs at Livermore we have maintained an active effort in trying to analyze the implication of the broad range of technologies and in the interplay between the various components of our architectures. We have examined the potential for SDI countermeasures and we have analyzed the potential vulnerability and hardening required for SDI-related assets should there be purposeful or inadvertent Soviet nuclear explosions involved. A useful example of the value of this analysis is that we have shown that by using a laser, ground-based or space-based, which is not particular effective in the boost phase, but couple that with an ability to discriminate of targets in the midcourse, you can develop a very effective system. It illustrates the very important point that isolated analysis of a single aspect of an SDI proliferated architecture can be very dangerous.

TECHNICAL ISSUES INVOLVED WITH DEPLOYMENT DECISION

The decision to proceed with development and deployment of a defensive system is a very complex issue that involves both technical and policy considerations. I would like to focus my remarks on the technical issues that are associated with a deployment decision. The technical issues must consider both the potential defensive moves and countermoves in order to ascertain whether or not in the long term defensive developments are cost effective against a responsive offensive threat. Thus, while a given defensive capability might be very effective against the current generation of Soviet threat, the decision to deploy must be based upon the potential for Soviet responses within the same time frame, and it must ultimately include a consideration of the impact of approximately mirror image capability for the Soviets.

AFFORDABILITY OF SDI

It is also very important to assess, in addition to the technical aspects, the affordability of not only the system but all of the supporting issues, the operational infrastructure and the industrial base which they require. It is the ongoing robust nature of the research program which must provide the assurance that an initial assessment of the desire to deploy provides long-term benefit for the country. Thus, in my view, while there are compelling reasons to proceed with development of some SDI relevant technologies like space-based sensors for tracking, like the heavy-lift launch vehicle for general space transportation, a decision to proceed with deployment should not occur until the full range of technical and policy options are feasible. There are very significant risks associated with a premature decision to deploy having to do with the timeliness of the U.S. counters and the Soviet responses.

SPACE-BASED KINETIC KILL VEHICLES

Let me try to be a little bit more specific. If we examine, for purposes of argument, a defensive system that is based on the space-based kinetic kill vehicles, there are a number of potential Soviet responses and which could negate these architectures and which are based only on near-term technologies. We have talked about them to a certain extent this morning, like the fast-burn boosters. Dr. Brown also mentioned the importance of a rapid deployment system. It is not only the issue of how fast the booster burns out but how fast the reentry vehicles can be dispersed from the booster itself. There are a wide variety of midcourse decoys and penetration aids that are also possible. Thus, if we chose a deployment decision based only on near-term technologies, we face the obvious problem of having them overwhelmed by Soviet responses, and we must have assurances that the more exotic technologies can provide the basis for an enduring and robust defense. The time phasing of these moves and countermoves, as you have discussed this morning, are very critical. Let me again be one layer more specific.

ACTIVITIES AT LIVERMORE

Livermore, in concert with a number of major defense contractors, has formulated a conceptual design of a fast-burn booster and a rapid post-boost deployment system which would negate the boost and seriously degrade the post-boost effectiveness of space-based kinetic kill systems. We must then ask the question, what is the value of the deployment of the space-based KKV if it can be overcome. We must look at the cost-effectiveness of the defense relative to the cost to the offense to respond to it and we must look at the time phasing. It is a political and policy decision whether or not it would be to this country's advantage to cause the Soviets to go away from the SS-18s by deploying a space-based kinetic kill architecture.

But it is clear in the long term that such an architecture could be overcome, and we must maintain the research into the more exotic technologies that have the potential of providing a robust defense in order to have a capability in the long term for defenses to play in national security. I do not believe that the country is yet in a position technically to begin active deployment of a major space-based system. While there have been important feasibility experiments, even the near-term technologies have not had proper system validation. The more exotic technologies which can give us the long-term enduring defense are very early in their history.

There are a number of major issues which have yet to be resolved having to do with the deployment of a heavy-launch vehicle, the construction of launch facilities, a greatly enhanced industrial base. I think there has been a very valuable lesson learned from the intense study of near-term architectures, and that is to point out the myriad of issues that must be solved before deployment of a real system can take place.

DELAY OF DEPLOYMENT

Let me summarize my two major points. First of all, it is much too early to begin deployment. In my judgment it will take at least until the early 1990's to have the technical data available upon which to base a decision. Second of all, because of the technical interplay between defensive systems and potential Soviet responses, the ongoing robust research program must provide a balance between near-term options and those long-term options which can provide an enduring and robust defense. Although it is much too early to proceed with deployment, I think it is very important, as recent studies have shown us, to engage in intense study of deployment and intense discussion of deployment of defensive systems, because those studies make known to us the full range of technical and policy issues with which we must address ourselves.

The goal of the SDI research program is to provide the technical basis and the technical answers to support a decision for deployment in the future. I support that approach and a continuation of a well-funded, well-balanced SDI program to examine both the near-term and far-term technologies. I believe that the support which SDI has enjoyed has directly contributed to the situation in which we presently find ourselves where there can be real optimism about the prospects for meaningful reduction in the levels of strategic arms. And I urge your contiuned support of the program.

[The prepared statement of Dr. Miller follows:]

PREPARED STATEMENT OF DR. GEORGE H. MILLER
ASSOCIATE DIRECTOR, DEFENSE SYSTEMS PROGRAM
LAWRENCE LIVERMORE NATIONAL LABORATORY

In March 1983, the President charged the nation with establishing a vigorous research program to find out whether defensive technologies can play a significant role in this country's future national security strategies. It is entirely appropriate to establish this focused research program at this time because of the significant progress which has been made in weapon, sensor, computational and system technologies since the early 1970's when the country elected not to pursue defense as a central element of policy. I enthusiastically support the need for a well funded, stable effort in the Strategic Defense Initiative (SDI) and remain optimistic about the future potential of many of the concepts; the current program, if properly funded, meets these needs. I am nevertheless cautious and mindful of the many technological hurdles we have yet to surpass.

Lawrence Livermore National Laboratory (LLNL) is a major participant in the national SDI effort. At LLNL, we are pursuing two major technology programs: the ground based Free Electron Laser (FEL) which is funded by the Strategic Defense Initiative Organization (SDIO) and the nuclear pumped X-Ray Laser (XRL) which is funded by the Department of Energy. There have been significant technological accomplishments in both these as well as the other technology programs which support the SDI research effort. There is still much that remains to be done.

Over the past three years, LLNL experiments have demonstrated at the component level the viability of the induction linac approach to the FEL. These experiments are largely responsible for the high priority placed on this approach by SDIO. We are continuing experiments on both the accelerator and the laser to ensure that the physics and engineering of the FEL ground based laser has the capability to perform in the context of a national defensive system. The present experiments will provide the data base and assurances required before a Technology Integration Experiment is constructed at White Sands Missile Range, New Mexico.

In addition to the development of the basic accelerator and laser, significant work remains to be done on the propagation of the laser beam through the atmosphere. Important experiments have been done at low power which indicate the feasibility of the concept. However both theoretical, engineering and experimental developments are required before we will demonstrate propagation at high power. These efforts are a major part of the current SDI ground based laser effort and apply in varying degrees to all laser weapon technology - space based as well as ground based - being considered for the SDI.

LLNL feels that it is important that the FEL technology developed within a national laboratory be shared and expanded on by private industry. In order to ensure that this technology transfer takes place, the laboratory has entered into a formal relationship with TRW. This program will enable a team from TRW to play the major role in constructing and operating an FEL facility at White Sands should SDIO decide to proceed with the induction linac FEL.

Even though the goal of SDI is a nonnuclear defense, the Defense Technology Study Team (DTST) noted in the summer of 1983 that a nuclear pumped x-ray laser in the hands of the Soviets could make the survivability of any U.S. space based defense a much more difficult prospect. These Nuclear Directed Energy Weapons (NDEW) are significantly different than either previous nuclear weapon based ballistic missile defense (BMD) systems or conventional Directed Energy Weapons (DEW). NDEWS are potentially small and light weight enough to be based on the ground and popped up into the battle space on demand. Instead of using one high yield warhead to destroy another high yield nuclear warhead, NDEWs hold the potential of using one moderate yield nuclear warhead to destroy many high yield nuclear warheads. The DTST thus recommended, and SDIO and DOE have agreed, to accelerate the research on the XRL in order to define better the potential threat to U.S. space assets or our retaliatory missiles. The XRL program at Livermore has made significant progress since 1983 toward its goal of actually demonstrating weapon level performance in an underground nuclear event. We still have much work to do, however, to fully assess the performance required for counterdefense potential or demonstrate the improved performance which could provide a defensive capability against current or responsively designed Soviet missiles. I strongly support the need for continued effort to understand the potential of these and other SDI technologies.

In addition to these two major technology programs, LLNL has maintained active Systems Analysis efforts in the broad range of technologies applicable to SDI and the interplay between different aspects of potential architectures. Our analysis has shown for instance that a ground or space based laser system which is only moderately effective in the boost phase against a responsive Soviet missile is very effective when employed throughout all phases and coupled with a means of damage assessment in the midcourse phase. We have also examined a variety of other issues having to do with potential Soviet responses to SDI deployments, vulnerability and hardening of SDI related assets and SDI system performance in an environment which has been disturbed by inadvertent or purposeful Soviet nuclear explosions.

The present SDI research program is directed toward providing the technical data which would support an early evaluation of the potential of defensive technologies to contribute in a meaningful way to U.S. national security objectives. The early decision milestone date is an ambitious success-oriented date, especially for the more advanced and innovative concepts. To meet this demanding milestone will require the support of the American people and the U.S. Congress.

The decision to proceed with development and deployment of any defensive elements is complex, involving both technical assessments and policy considerations. Some policy considerations which the national decision makers have had to analyze include the impact on extended deterrence and stability of a defense-dominated strategic posture, the role of arms control to manage offense reductions while defenses are being deployed and the impact on strategic balance and deterrence of combined offensive and defensive forces in a competitive environment. Moreover, there are many types of defensive objectives, ranging from nearly leak-proof defenses to more limited defenses. The value and advisability of each must be assessed.

The technical assessment must consider potential moves and countermoves by the two sides and ascertain whether or not, in the long run, defenses are cost effective on the margin to responsive offensive force developments and the evolution of counterdefense capability. Thus, although a given defense might be effective against the current Soviet threat, the assessment of deployment must include the deployment time scale and the potential for Soviet responses within the same time frame. This assessment must ultimately include consideration of the impact of approximately mirror-image technology for the Soviets. Furthermore, the technical assessment must also address the availability and affordability of supporting systems, operational infrastructure and the technical and industrial base which they require.

The ongoing research program by providing both near-term and long-term options is required to provide a high-confidence assessment of the cost-effectiveness of an enduring, robust defense. The policy issues of a secure and stable future will be difficult to formulate, much less resolve, until the technical issues on the full-range of options are explored.

In my view, while there are already compelling reasons to proceed with development of some SDI relevant technologies, a decision to proceed with deployment of proliferated defensive systems should occur when the full range of technology and policy options to support the decision appear feasible. Risks associated with a premature decision have to do with the relative timelines of Soviet responses and U.S. counters adequate to maintain effectiveness. Let me expand on some of the technical issues.

One part of the SDI research program has focused on early warning and attack assessment. As the capability of these kinds of technologies is improved, these elements as well as others that have applications outside of the SDI mission merit consideration for deployment. Similarly, SDI and other elements of the US space program have need of a heavy lift launch vehicle.

With regard to SDI weapon technologies, deployment of Space Based Kinetic Kill Vehicles (SBKKV) and the Exoatmospheric Re-entry Vehicle Interceptor System (ERIS) would be able to reduce the size of an attack of current-generation Soviet boosters and reentry systems. The ERIS system could be effective in a preferential defense of key Command, Control, Communications and Intelligence systems (C3I) and leadership assets, enhancing the deterrence of a Soviet decapitation attack. SBKKV, together with ERIS, would significantly reduce the feasibility of limited nuclear strikes against the U.S., protect the country from accidental launches, and reduce the potential damage on the U.S. from large Soviet boosters (SS-18) if deterrence were to fail.

There are a variety of possible Soviet responses which could ultimately negate defensive architectures based only on near term defensive weapon technologies if we prevent the defense from evolving over an extended period. The possibilities include the development and deployment of fast burn boosters and rapid deployment systems, the development and deployment of midcourse decoys and terminal phase penaids, and the use of IRBMs and ICBMs as defense suppression weapons. It is the developments from the on-going research program which could allow the defense to evolve over an extended period and permit continued effectiveness. The evaluation of the time phasing of the counterdefensive potential relative to defensive deployment is critical. The ability of follow-on defensive development to convince the Soviets that they cannot overcome the defense is also critical to a decision to proceed with deployment.

For example, LLNL studies in concert with several major defense contractors have formulated a conceptual design of a fast burn booster and post-boost vehicle which would negate the boost phase mission and seriously degrade the post-boost effectiveness of some SBKKV architectures. In this environment we must then evaluate the residual value of these platforms and the potential for countermeasures in the midcourse. A concerted effort by the Soviets has the potential to make these technologies available in the same timeframe as a defensive deployment. Whereas these and other possible countermeasures are technically feasible, it is important to understand how near-term counterdefense performance impacts the prescribed military missions and the cost of the defense relative to the cost of the Soviet counterdefense. It is clear, however, that ultimately a defense based only on the near-term presently mature technologies can be overcome. The ongoing research into the more "exotic" technologies must be in a position to provide options that could maintain defensive effectiveness against Soviet countermeasures should they be pursued. The balance between near-term and far-term technologies can give answers to the questions of whether an enduring robust defense is possible and whether a given near-term option will move the country in the proper direction.

The country is not yet in a position technically to begin active deployment of a major space based defensive system. The demonstration of the basic elements of a near-term system has yet to be accomplished. Very important feasibility experiments have been successful, but these are a long way from system validation. In addition to these technology issues, there are important operational requirements that would have to be met. For example, early deployment of SBKKV and ERIS could not be accomplished on schedule with a business-as-usual approach. It would require parallel development of many elements of an integrated system. Very rapid development of a launch vehicle to put hundreds of thousands of pounds into space at an affordable price would be necessary. Our present launch facilities and ground support elements for space operations would require significant expansion. Significant growth of parts of our industrial base would be required in order to respond to the increasing demands of deployment. A very valuable outgrowth of intense study of near term architectures is the focus on the myriad of issues surrounding deployment of a real system.

Although it is much too early to proceed with deployment of proliferated defensive systems, it is very important to engage in intense study and discussion of the actual deployment of defensive systems in order to understand better the full range of technical and policy issues which must be addressed before deployment can proceed. We must have in place the strategic policy or arms control framework with which to deal with defenses. We must have in place a plan for deployment; the concept of phased deployment is a plan that is currently being discussed. We must have answers to all the technical questions. To maximize the confidence in a deployment decision, we must have as much technical information as possible as soon as possible about feasible evolutionary paths for both offensive and defensive systems. That is and has been the goal of the SDI. I support that approach and the continuation of a well-funded, balanced SDI research program to examine both near term and far term technologies to support the President's goal.

CLERK'S NOTE: Subsequent to the hearing, Dr. Miller asked to have the following additional comments included as part of the record.

In reviewing my testimony and responses to questions, I would like to make a few additional remarks for the record. At several points in the questioning, I was asked whether I agreed with the testimony of Dr. Harold Brown. I strongly agree with Dr. Brown's general perspectives: that it is unrealistic to proceed with deployment of an SDI system based on space-based kinetic kill vehicles at this time, that counters to such a system could be developed and deployed more easily, quickly, and cheaply than the defense itself and that the research program should provide a balance between the near term and more advanced technologies with an emphasis on the more advanced technologies. However, I believe he has been somewhat pessimistic in his prediction that the more advanced tehnologies will not be available until after the year 2005. A well ordered, but aggressive program could have them available before the year 2000 if the initial research proves them feasible. Similarly, the advanced technologies with which I am most familiar can certainly usefully grow at a greater rate than 10-15 percent per year in order to prove the feasibility of the concepts. Finally, I disagree with Dr. Brown's conviction that SDI lacks a fair chance of achieving a needed goal. While it is much too early to begin deployment, it is also much too early to pessimistically predict the outcome of this important research program. Indeed, I believe that there is good reason for optimism that an aggressive SDI research and technology program coupled with meaningful arms control can contribute positively to the nation's security.

OVERCOMING TECHNOLOGICAL CHALLENGES

Chaiman STENNIS. Would you mind repeating that next to the last sentence?

Dr. MILLER. Yes, sir. I believe that the support which SDI has enjoyed has directly contributed to a situation in which I believe there can be real optimism about the prospects for meaningful reductions in levels of strategic arms.

Chairman STENNIS. All right. I have just a few questions, and we will proceed with our questions and answers, gentlemen.

You discussed some of the technological and scientific challenges remaining in major SDI programs. You have talked about the space-based kinetic kill vehicles and the ground-launched interceptors known as ERIS. Can you elaborate on the major complexities involved in overcoming the challenges? Can you say what level of risk is involved in overcoming each challenge, high, medium, or low?

Dr. MILLER. Certainly the ability of the country to deploy a space-based KKV system in its simple form is relatively straightforward. There are still issues having to do with the ability of the sensors to find the booster to be shot at and the ability of the midcourse to discriminate against the existing Soviet decoys. I do not believe that there is high risk in either program at this point. However, my concern is that a defense based solely on these technologies will not provide an enduring capability. In the case of the longer term technologies, which are what I believe will provide the ultimate defensive capability, there are major scientific questions that have to be resolved. I am very optimistic about the potential for these technological developments. However, I think it is entirely appropriate to demand demonstration as opposed to basing a decision on calculational projections. It will take, in my view, at least until the early nineties to have that technological support.

Chairman STENNIS. Well, that is all I have now. Senator McClure, we will turn to you.

Senator MCCLURE. Thank you very much, Mr. Chairman.

SUPPORT OF WELL-FUNDED SDI PROGRAM

Dr. Miller, you probably know that a number of people in this country view you as an outspoken opponent of SDI. If I read your statement correctly and hear you correctly, you do not want to be characterized in that way.

Dr. MILLER. Yes, sir. As I said in the opening part of my statement, I am an enthusiastic supporter of a well-funded, well-balanced program directed at strategic defense technologies.

Senator MCCLURE. Now, the Lawrence Livermore Laboratory is working on two laser technologies, and you have an oversight capability study more broadly based. Am I correct? That is your major activity?

Dr. MILLER. Yes, sir.

Senator MCCLURE. FEL is a ground-based system. Is that correct?

Dr. MILLER. The version that Livermore is pursuing, the induction linac approach, will probably only be ground-based. There have been some discussions about the RF approach, which is being pursued at a different laboratory as having a potential for being space-based.

FEL POTENTIAL AGAINST BALLISTIC MISSILES

Senator McClure. What is the potential of an FEL against ballistic missiles?

Dr. Miller. The free electron laser, any ground-based laser system, if you can get to sufficient powers, and we believe we can, and if you can overcome the technical difficulties in propagating the laser beam through the atmosphere, has the potential for attacking even the responsive fast-burn booster.

Senator McClure. It could attack it during the boost phase?

Dr. Miller. Yes, sir, during the boost and post-boost phase.

Senator McClure. Then what you are suggesting is, it has the potential of long-range firing?

Dr. Miller. Yes, sir.

Senator McClure. Through the atmosphere?

Dr. Miller. Yes, sir.

Senator McClure. It is not just the short-range incoming vehicle that would be targeted?

Dr. Miller. That is correct, sir.

FAST-BURN VEHICLE

Senator McClure. I am trying to get a little bit of a handle on this question of the fast-burn vehicle. If I understand the problem correctly, the real problem is the difficulty of finding and tracking a ballistic missile.

Dr. Miller. I do not believe that there is any difficulty at all in finding and tracking a ballistic missile while the rocket is burning. The major issue with the fast-burn booster is that the time in which you have to act is greatly shortened, and, therefore, for weapons that have to fly to the target, like a space-based KKV, you physically cannot get from the orbit that they are in to the booster in the time that is available.

Senator McClure. Is there a quantitative difference between acquiring the target and tracking the target?

Dr. Miller. It is certainly easy to find in a general sense a booster that is burning, because it is very bright.

Senator McClure. I am not talking about that. I am just talking about the difference between finding it in the first place and tracking it after you find it.

Dr. Miller. There certainly could be a difference because finding it in the first place can be on a dedicated platform that just sort of sits there and looks in tracking to the target to hit it. You want the vehicle to be as small as possible, and so there are issues with miniaturization. I do not believe that that will ultimately be a problem, though.

Senator McClure. Right now where you have fixed-base missiles it is easy to acquire because you know the source. If you are looking at mobile missile launchers, whether it be submarine or ground-based, they are harder to find because you do not know where they are going to come from.

Dr. MILLER. Again, I would expect it is possible to develop a platform that sits at geosynchronous orbit that can look at a large fraction of the Soviet Union at a single time and can look at a large fraction of the ocean at a given time.

Senator McCLURE. What I am really getting at, and knowing a little bit about weapons but not an awful lot about weapons, is that once you have found a target and locked onto it, it is easier to track than it is to find it in the first place?

Dr. MILLER. I would not make that statement. I would say the difficulties are probably similar.

Senator McCLURE. They are similar. It is just as hard to track them as it is to find them?

Dr. MILLER. I believe so. I do not think either one is particularly hard as long as the rocket is burning.

Senator McCLURE. But for either system you have to find it while it is burning, and track it while it is burning, in your view, or you multiply your difficulties a very great deal?

Dr. MILLER. That is certainly true. When the vehicles have stopped burning they become much more difficult to find.

Senator McCLURE. All right. Fast burn can be very fast indeed. It has a very large plume, easier to find than a slower burn because it is a larger plume. Is that correct?

Dr. MILLER. I would expect the plumes to be similar, sir.

Senator McCLURE. But you have got a much shorter time frame?

Dr. MILLER. Much shorter time is the issue.

Senator McCLURE. And that would be equally true with respect to a ground-based laser?

Dr. MILLER. That is correct.

Senator McCLURE. So your time frame, regardless of what your system is, is going to be an equal challenge for an FEL?

Dr. MILLER. In terms of the time available, that is absolutely correct. The difference is that, for a free electron laser or any laser, the bullet, if you will, is traveling at the speed of light, which is very fast indeed, whereas for a space-based KKV rocket the velocity at which it moves towards its target is much slower.

Senator McCLURE. What is the burn time on a fast burn?

Dr. MILLER. It again depends in great detail on how hard you want to work at it. The original projection that was done by the Fletcher study was a 50-second burn that is very stressing technology. Our studies indicate that you can get the majority of the value for 80 or 100 seconds of a fast burn booster, and that is much, much easier technology for the missile designers.

WEAPONS USED AGAINST FAST-BURN

Senator McClure. Whether it is 50 seconds or 100 seconds, taking an FEL for example, assuming you solve the problems, the physics problems of projecting that laser through the atmosphere for great distances with accuracy, then you would have theoretically 50 seconds to 100 seconds to detect the launch of the vehicle, to locate where it was, to track it, to be able to aim your laser and fire the laser?

Dr. Miller. That is correct.

Senator McClure. But you think that is not unsolvable?

Dr. Miller. It is a very difficult problem. It is not unsolvable.

Senator McClure. Are there other weapons that could be used against fast burn?

Dr. Miller. Any of the lasers, whether it be a ground-based free electron laser, a space-based chemical laser, any of the lasers can attack the fast-burn booster.

Senator McClure. But you think it has to be a laser and can be nothing else?

Dr. Miller. I am not personally aware of another technology that holds the potential.

Senator McClure. And there your real focal point is the speed at which it attacks?

Dr. Miller. The speed at which the bullet flies.

Senator McClure. And the distance which the vehicle can travel while you are seeking to intercept it?

Dr. Miller. That is correct.

Senator McClure. And again, just to make certain that I understand what the basis of your testimony is, you believe the SDI is a viable program? I am not trying to put words in your mouth. I am trying to summarize to see whether I understand you correctly.

You believe the SDI program is well conceived and, if adequately funded and supported by the Congress and the American public, it has a high potential for success?

Dr. Miller. Yes, sir. I believe that as a research program it is a well-conceived idea and entirely appropriate. The potential of the technologies is there, but it will take several years, in my judgment the early 1990's at the earliest, to provide the technical basis upon which to make an informed decision.

Senator McClure. Do you believe that the Soviet Union is today having economic difficulties internally?

Dr. Miller. That is not a subject that I am in any position to comment on.

Senator McClure. That is the first time I ever heard a scientist who assumed that he did not know it.

To put it the other way around, I have heard a good many scientists who assumed they knew everything about everything. And I accept your answer.

Dr. Miller. Maybe I am more realistic or more humble or something.

Senator McCLURE. I guess I could say the same thing about members of Congress.

The reason I ask that question is, if indeed it is true that they are stressed economically, as many people are suggesting today, and that they are seeking accommodation with the West because of their internal economic stress, then some of the alternatives in offensive capability may be beyond their economic capacity without further stress. But I gather that you do not feel competent to comment upon that aspect.

Dr. MILLER. No, sir, I do not.

Senator McCLURE. Thank you very much.

Thank you, Mr. Chairman.

Chairman STENNIS. All right. Thank you.

Senator Johnston, do you have something further?

Senator JOHNSTON. Thank you, Mr. Chairman.

KKV PROGRAM

Dr. Miller, first of all, I would like to say that you and I have had conversations and I have quoted you, and I apologize for that. I think it is unavoidable because we are dealing with the economic health of the country, if not the future of mankind.

You are the man charged with it, and I want to apologize for having put you on the spot. But I want to say for the record, which I wanted to say initially, but I want to make this very clear, you at no time have come to me to volunteer any information about KKV's.

When you and I first had a conversation in my office, I believe it was on the testing that you came to talk about. And I said: Well, while you are here let me ask you about KKV's, because I knew you were in charge of the program. I hope the message will get back to the administration that Dr. George Miller has not been trying to undermine the SDI program by trying to shoot down space-based KKV's; rather as a serious and credible scientist, you have answered questions, period.

Mr. Chairman, let me say that this administration has come out with some new regulations which would prohibit scientists in our national labs from volunteering information, from giving us information. I think if we let them get away with that it would just be devastating to the role of Congress and the role of the national labs.

I think the national labs are a great source, an irreplaceable source of information, of expertise. And if we start muzzling our national labs and our serious scientists, it would be devastating, I think, for the country.

So I really want to defend Dr. Miller. He has not been trying to shoot down anything. He answers questions, and I think he answers them honestly.

Now, having said that, you heard Dr. Brown testify. He testified on SDI and on the treaty. Leaving aside what he said about the treaty, because he has special expertise on that, was there anything in his testimony with which you basically disagreed?

Dr. MILLER. No, sir, there was not.

SOVIET FAST-BURN BOOSTERS

Senator JOHNSTON. Dr. Brown said—you heard the questioning saying fast-burn rockets defeat the space-based KKV, that the Soviets could surely deploy a fast-burn rocket system before we could get up a space-based KKV system, and that the relative cost—I think he used the multiple of five or ten to one in favor of the Russians.

Do you agree with those judgments?

Dr. MILLER. The only caveat that I would add to that is that the statements are specifically oriented towards the boost and post-boost phase. Space-based KKV's may have a continuing role if coupled with discrimination in the midcourse.

But in terms of the ability of the Soviets to design and deploy a fast-burn booster on a rapid time scale, based on our own studies, I agree with that. I agree with the numbers that he quoted for the costs to the Soviets of developing a fast-burn booster.

We, in fact, even have some ideas that suggest they would not have to develop a brand new fleet of missiles, but merely modify the ones that they have. And I similarly agree that a cost of a few hundred billion dollars for a major space-based system is more realistic than 40.

Senator JOHNSTON. Thank you very much.

If you cannot get ICBM's in the boost phase, you can pretty well forget a goal of Astrodome or even 90 or 95 percent at any kind of reasonable cost, affordable cost?

Dr. MILLER. At this point I do not have in mind an architecture that could provide a major defense without a boost or post-boost phase associated with it.

Senator JOHNSTON. What I am getting at is, if you can defeat a space-based KKV by fast burn and you can do that in the boost phase, the goal of an SDI of trying to be 90 percent or 95 percent or Astrodome, as a practical matter you can forget that goal, can you not?

Dr. MILLER. Certainly based on the space-based KKV, a leakproof defense is not feasible. As I tried to indicate earlier, I believe that some of the more exotic weapons still hold the potential. We have a long ways to go to demonstrating that.

SPACE-BASED KKV

Senator JOHNSTON. I understand that, and I quite agree with you on that. But first let us address the space-based KKV, because that is the current issue. I mean, you read in the morning paper the question is deployment decision now on space-based KKV, and that is why I want to get into that.

There is no potential that you know of, either in theory or in practice, of a space-based KKV to have interactive discrimination during the post-boost phase, is it not?

Dr. MILLER. If you rigorously mean the post-boost phase as opposed to the midcourse——

Senator JOHNSTON. Once you deploy the garbage and the chaff or whatever the decoys are.

Dr. MILLER. The issue in the midcourse is not the space-based KKV. The issue in the midcourse is the ability to find what you want to shoot at. In the midcourse with space-based KKV's or any number of other kinds of systems, you have plenty of time in which to shoot, but you must find them.

And so——

Senator JOHNSTON. You must discriminate between the real and the decoys.

Dr. MILLER. That is absolutely correct. The weapons system is not the issue. The issue is then, as I used the example of the laser for a weapons system in the boost phase, there are many very important technologies that are being looked at for sensors and for discrimination to try and see if we can solve the midcourse problem.

I am not going to give up that the midcourse is an unsoluble problem.

MECHANISM FOR SOLVING FAST-BURN ROCKETS

Senator JOHNSTON. But we are really talking about the mechanism for solving that. The practical mechanism that you have under consideration is really with one of the beam weapons, which can either bathe the rocket, the warhead, in some kind of a beam, which in turn can be sensed, is that not correct?

Dr. MILLER. That is one of many ideas for discriminating in the midcourse. They could be beam weapons. They could be much more sophisticated sensors, a whole variety of techniques.

Again, the question that has to be answered in an architectural sense is whether or not, once you find them, the space-based KKV is the appropriate way to attack the residual assets.

Senator JOHNSTON. And your judgment is that it is not?

Dr. MILLER. In my judgment, it can. You have plenty of time for the kinetic kills to attack in the midcourse. The issue of whether it is the best or not will be determined by the outcome of the technology development in the more exotic systems.

Senator JOHNSTON. Dr. Miller, you have responsibility at Livermore Labs overall for SDI evaluation and some direction in the research, do you not?

Dr. MILLER. Yes, sir.

Senator JOHNSTON. So it is not fair to say that Livermore is limited to free electron laser and X-ray laser?

Dr. MILLER. Those are the two major technology programs that we are working on. We maintain an active analysis in the full range of systems.

Senator JOHNSTON. When I confronted General Abrahamson the other day with your statement to the effect that fast burn would defeat the KKV and that this was within the capability of the Soviet Union, I said what would that mean. His response was: Well, some scientists are well-meaning scientists, but jealous of their own particular technologies which they are pursuing.

Is your judgment clouded at all by the fact that you are working on X-ray lasers and free electron lasers?

Dr. MILLER. I certainly hope not, Senator. My intent is not to push Livermore's programs, but to provide a perspective on the broad range of issues surrounding SDI.

Senator JOHNSTON. Do you agree with Dr. Brown that a 1993–9494 timeframe deployment is absurd?

Dr. MILLER. I think that the appropriate time to discuss a decision to deploy is the early 1990's. It will take several years after that before you could begin to deploy. So I do not disagree with his assignment of deployment beginning in the late 1990's.

COST-EFFECTIVENESS OF SDI

Chairman STENNIS. All right. Well, doctor, just two brief questions, fairly brief. One of the three major criteria for judging SDI systems is whether they are cost effective at the margin, that is, can they counter efforts to defeat them less expensively than the cost to the Soviets to mount those efforts.

Now, your laboratory, as I understand it, is active in this area. So do early deployment systems pass this important test? What are the implications of such an assessment for the current orientation of the SDI program as proposed in this budget?

Dr. MILLER. I think the issue of cost and cost tradeoffs on the margin are very important criteria for use in judging the strategic defense initiative. In response to an earlier question, I stated I believe that the deployment costs for the near-term technologies are larger than the cost of Soviet responses.

One must still judge, however, from a policy situation whether or not it is advantageous to try to push the Soviets away from the current generation of missiles. In my judgment, the current SDI program does provide a balance between near-term potential, because there are many other ways of using a space-based KKV—it does provide the balance between near term and far term.

Everybody can always use more money, and, in my judgment, the issue is one of balance.

MILITARY EFFECTIVENESS AND SURVIVABILITY OF DEPLOYMENT

Chairman STENNIS. All right. I think your testimony is of value there, and I think this question is plaguing more people and more of those of us that have got to make some decisions, 12 months' worth each year.

I know I am concerned, although that must not be the absolute only controlling influence. Now, do you believe that the early deployment defenses being contemplated by the SDI program meet the other two main criteria endorsed by the executive branch and the Congress, that they be militarily effective and that they be survivable?

Do you want to comment on that?

Dr. MILLER. Yes, sir. First of all, I guess I would say, based on my own knowledge, a characterization of the current SDI effort is that they are studying the issues around the near-term technologies. They are not in a position to decide on deployment at this time, and I strongly believe that it is not time to deploy.

The systems that they are looking at are very valuable in terms of elucidating this series of issues. If you assume that neither the Soviets nor the United States respond to the initial deployment, they can be both effective and survivable and, as I have tried to indicate, however, the issue then becomes what is your judgment as to the timeliness of Soviet responses relative to the timeliness of the deployment of the system in the first place.

Chairman STENNIS. All right.

Senator McClure, back to you.

Senator McCLURE. Mr. Chairman, I have just a couple of questions, perhaps.

FEL DEFENSIVE SYSTEM

Dr. Miller, if I were to take a look at FEL as an example of a future defensive system, it must be able to look broadly at the entire territory of the Soviet Union and also the sea surface of the globe wherever Soviet nuclear subs might be located, in order to determine whether an attack was being initiated.

If I say something you do not agree with——

Dr. MILLER. That, by the way, is no different from any other system.

Senator McCLURE. So you have got to be able to look at the Earth's surface at the appropriate places and be able to detect almost instantaneously the launch of any missiles, and particularly if it is any sizable number of missiles.

Dr. MILLER. That is certainly a correct statement. We have the exact same issue today, and our early warning satellites perform that function now.

Senator McCLURE. Are they 100 percent effective?

Dr. MILLER. I do not know the answer to that question, sir.

Senator McCLURE. Is it necessary that they be 100 percent effective?

Dr. MILLER. It depends upon what kind of defense you want, whether you want a completely effective defense or whether there are military missions that are acceptable to you at less than perfect defense.

Senator McCLURE. Would you say, if they are not 100-percent effective, we should not have them at all?

Dr. MILLER. No, sir, I would not.

Senator McCLURE. Now, assuming we have a detection system that could detect the launch of numerous—and I assume when we are talking about numerous, a first strike attack on the United States; we are not talking about a half a dozen or a dozen. We are talking about the launch of many, many ballistic missiles.

Dr. MILLER. Yes, sir. The way the studies are always done is to take the most stressing situation, which is the simultaneous launch of like 1,000 boosters.

Senator McClure. So we would have to have a system that can with relative efficiency determine the simultaneous launch of say 1,000 missiles, or near simultaneous. We must also be able to have a system that would be able to not only locate, but determine their flight path and aim a laser weapon at them to destroy them and fire that laser weapon?

Dr. Miller. The only thing that is different in the FEL architecture or the space-based KKV architecture is the aiming and firing of the laser. Everything else is necessary for any architecture, and in fact necessary for the early warning systems that we contemplate today.

Senator McClure. Are you confident that such a system can be 100 percent effective?

Dr. Miller. I am not confident that it can be 100 percent effective, no, sir.

Senator McClure. Does it have to be 100 percent effective to be worth doing?

Dr. Miller. The answer to that again is a policy question, which I would rather stay away from. It depends upon your judgment of the value of 100 percent defense relative to the value of a more limited defense.

Senator McClure. I guess the reason I asked you that question, Senator Johnston had asked you a rather broad question, to which you gave a rather broad answer, and that was whether Secretary Brown had said anything with which you disagreed.

And I think your answer was, "No," everything he said you agreed with.

Dr. Miller. I thought I said most things.

Senator McClure. Aside from the question of the interpretation of the treaty, I think that is the way Senator Johnston asked the question.

As I read Secretary Brown's statement, he is saying that a system that is no more than—that is less than 95 percent accurate, 95 percent effective, is not worth doing. And I gather from your answer to me just now you would rather not express an opinion as to whether that is worth doing or not.

Dr. Miller. Again, that is a policy-type question and a military strategy question that the Joint Chiefs of Staff would be better prepared to answer than me.

Senator McClure. Thank you very much.

Chairman Stennis. The Senator from South Carolina, Senator Hollings, has requested putting these questions in the record for answers. If there is no objection, it is agreed to.

Chairman Stennis. Senator Johnston, do you have further questions?

Senator Johnston. Yes, Mr. Chairman.

I do not see where Dr. Brown said that a less than 95 percent system is not worth doing.

Senator McClure. Bottom of page 2.

Senator Johnston. "Survival as a nation is conceivable as a goal if arms control were to limit ballistic missiles to a few hundred and a defense were 95 percent effective—by no means an effectiveness that is feasible with anything that we know."

You do not disagree with that?

Dr. MILLER. No, sir.

Senator JOHNSTON. There is no need to argue about what he said and what he did not. But I just did not happen to see that.

DEPLOYMENT DATE DECISIONS

Now, Dr. Miller, you say that we should not make a decision now as to deployment, that that decision will not be right until the early 1990's timeframe. There are those who are pushing for a decision now as opposed to a decision in the early 1990's timeframe.

I think that is the fundamental question facing the country, and to me it would be a very bad decision because it locks you into space-based KKV. As Dr. Brown says, that is the only thing ripe for decision. These other things, you are not even ripe for decision on.

Would you tell me why we should not make that decision now, why we should not lock ourselves into space-based KKV this year? I am not talking about deployment this year but making the decision this year.

Dr. MILLER. Again, I believe it would be a big mistake to decide today to go ahead with defense because we do not have the technical data that allows us to be assured of a robust and enduring capability of defense.

I think to move away from the strategy of the country for the last 30 years of deterrence requires a very conscious and well-supported decision. Where nuclear weapons are concerned, the name of the game for me is caution. We have something that works, and we better be sure that we have something that works before we move away from it.

Senator JOHNSTON. I understand that, and you have made it very clear that you think fast burn defeats space-based KKV and all that. That is very clear from both you and Dr. Brown.

What I am getting at is what do we lose by making that decision now. Do we not lock ourselves into space-based KKV because no beam weapons even exist at this point that can be deployed in space? So do you not have to go choose the space-based KKV and lock yourself in that direction, which in turn takes away from your other research in FEL or x-ray laser?

Dr. MILLER. In the context of a fixed pot of money which the country must divide up and a fixed pot of money that the country is willing to put into SDI, a decision to go solely with the space-based KKV will affect, in my view, significantly the capability to develop a long-term enduring defense through the more exotic technologies.

Again, one of my major points is the necessity of maintaining that robust research program.

Senator JOHNSTON. All right, Dr. Miller, you had submitted a draft to this committee a few days ago, and your final testimony is a little different. There were some changes in that specifically referring to the early 1990's decision date.

How were those changes made?

Dr. MILLER. I decided to make the written testimony more general. I did not believe it changed the intent, so my desire was to make the statement more general and specific.

Senator JOHNSTON. Well, you have not told me why this was changed. I have not discussed it with you at all, so I am not whispering something or saying something that you have whispered to me.

Was that entirely your idea, or did somebody suggest it?

Dr. MILLER. It was suggested by a wide variety of people, many within the laboratory. I would not characterize the differences between the original draft and the final prepared testimony as being the result of pressure.

ORBITING SBKKV VEHICLES

Senator JOHNSTON. Dr. Miller, is there now conceived a defense for your orbiting SBKKV vehicles, or would they not be very liable to be shot down in all kind of different ways?

Dr. MILLER. There are certainly major studies that SDI has done on the survivability of these assets. I have not participated in those and am not directly knowledgeable of them.

I believe that the survivability of any space-based asset is a major concern. The strategic defense initiative believes by a combination of decoys, maneuverability, and Stealth that they can provide survivability, but I am not in a position to either agree or disagree with them at this point.

FAST-BURN ROCKETS

Senator JOHNSTON. Dr. Miller, way back in the 1960's they were talking about fast-burn rockets with burn times of, I think, 90 seconds. They also pointed out that, until a rocket gets up at about 35,000 feet, it is below the humidity layer of the cloud layers, and so forth, and the heat signature cannot be detected from space.

That phenomenon continues to exist today, does it not?

Dr. MILLER. Yes, sir. We assume that the beginning of track is above the cloud tops.

Senator JOHNSTON. So a 90-second, fast-burn rocket would actually be detectible only for that part above 35,000 feet, which might be only two-thirds, 60 seconds?

Dr. MILLER. That is correct, sir.

Senator JOHNSTON. So when we talk about instantaneous detection, we do not instantaneously detect. We do that only above the cloud level, if there is a cloud level?

Dr. MILLER. Yes, sir.

Senator JOHNSTON. I have some written questions here from Senator Proxmire, Mr. Chairman. I would ask unanimous consent that they be put into the record.

EARLY DEPLOYMENT OF SBKKV

Senator JOHNSTON. Let me ask you. If you deploy an early SBKKV system, would it have to assume the existence of a crude Soviet x-ray laser?

Dr. MILLER. Again, it depends upon the time scale. In my view, if our research program works the way I expect it to, the x-ray laser as a demonstrated threat could exist in the mid-1990's.

Senator JOHNSTON. Dr. Miller, what do you think is the earliest practical date for deployment of an SBKKV system?

Dr. MILLER. Again, it depends upon your definition of the word "practical." I believe, as I said earlier, that the 1997 timeframe that Dr. Brown referred to is a reasonable expectation.

Senator JOHNSTON. All right. Since the question was asked about Dr. Brown, the question of whether you agree with all or most, do you recall anything in his statement other than that which related to the treaty, which you are not an expert on, with which you disagree? If so, what?

Dr. MILLER. No, sir, I do not recall anything that caused me a great difficulty.

Senator JOHNSTON. All right, thank you very much, Mr. Chairman. Thank you, Dr. Miller.

Chairman STENNIS. Thank you, Senator.

Well, again, we want to warmly thank you on behalf of all of our committee and everyone connected with this problem and the decisions that have got to be made. I do not want to flatter you on that, but I think you are a highly competent witness, and your testimony has been of help to me and I think to the other members.

Is there anything you feel that you should add?

Dr. MILLER. No, sir; I think we have covered it very well. I appreciate the opportunity.

Chairman STENNIS. We may be calling you again.

Dr. MILLER. Thank you very much, sir.

Chairman STENNIS. We want to thank you. Sorry we had to drag this thing out a little extra, but you know, it is very obvious we had to go to the floor and have to go back shortly now.

Well, the door will be open if you would like to come back to see us.

Dr. MILLER. Thank you very much, sir.

SUBMITTED QUESTIONS

Chairman STENNIS. The additional questions submitted by committee members will be inserted in the record at this point.

[The following questions were not asked at the hearing,but were submitted to the Department for response subsequent to the hearing:]

QUESTIONS SUBMITTED BY CHAIRMAN STENNIS

(Questions answered by Dr. Harold Brown)

Question. Which nation is more capable of taking advantage of the broader interpretation of the ABM Treaty to develop effective futuristic strategic defenses if that interpretation is adopted by both? If the ABM treaty is abrogated, which nation is more capable of deploying futuristic strategic defenses?

Answer. The U.S. currently has greater technological ability to take advantage of the broader interpretation of the ABM Treaty to develop space-based strategic defenses if both the United States and the Soviet Union adopt that interpretation. This applies to sensors, command-control and communication systems, directed-energy weapons, and space-based kinetic kill vehicles (whose development I think is not allowed even by the broad interpretation). The balance is not completely one-sided, because the U.S. will, as a consequence of the delay in the shuttle program, lack over the next few years the ability to lift many heavy payloads into space. However, most experiments could be carried out with existing expendable launch vehicles. The ability of the U.S. to persist in political and economic terms with such a program over a long period may be poorer than that of the Soviets, given the fluctuating nature of U.S. defense program decisions and funding. The Soviets have displayed considerable determination not to be left behind in advanced technology and, though the U.S. has, in general, been able to keep ahead, the Soviets' determination and political will have allowed them often to equal and in some cases even to exceed U.S. capabilities.

If the ABM Treaty is abrogated, the U.S. probably will be more capable of deploying futuristic strategic defenses, in the period beginning after the year 2000, providing again that the U.S. technical capability is matched over the next two decades by a consistent strategic approach and the funding to back it up. It is important to note, however, that the Soviets are in a much better position than the U.S. to deploy ground-based antiballistic missile systems of existing design. They have equalled U.S. technology in that area and have a going production line. Thus, they could deploy a nation-wide defense of the Soviet Union within ten years or less. The U.S. could undoubtedly penetrate such a system and maintain its deterrent capability, but, in order to do so, we would have to expend large amounts of money and alter our programmed ballistic missile forces.

Question. Would the types of defensive systems apparently being considered for early deployment be considered as based on "other physical principles" under the terms of the ABM Treaty and thus eligible for more widespread development and testing under the broader interpretation of the treaty? Why or why not?

Answer. My own judgment is that the space-based kinetic kill vehicles (KKVs) apparently being considered for early deployment would not qualify as being based on "other physical principles" under the terms of the ABM Treaty, even under the broader interpretation of the Treaty. Those vehicles are interceptors, and the satellites from which they could be launched are launchers. The BAMBI system proposed by the Air Force for ballistic missile intercept from orbit in 1959 through 1961 was to use essentially the same rocket design, a similar infrared guidance system, and a kill either by impact or by nearby conventional explosion. Thus the kinetic kill vehicle part of the proposed SDI early deployment is based not only on physical principles but on a design known at the time of the ABM Treaty in 1972. It should be added that development and testing of the ground-based components, HEDI and ERIS, of the defensive system proposed for early deployment is allowed under the narrow interpretation of the ABM Treaty, because they are fixed and ground-based.

Question. Why should the U.S. be concerned about maintaining the ABM Treaty environment, since the Soviets have already clearly violated the treaty in one way and may be approaching other violations?

Answer. The Soviets will have violated the ABM Treaty if and when they turn on the Krasnoyarsk radar without having altered its nature from that of an early warning radar. It may yet be possible to resolve that issue, as other past questionable practices of the U.S.S.R. and some that the U.S.S.R. alleged of the U.S. have been resolved, by discussion in the SCC and action to explain or to change the practice. The U.S. should be concerned about maintaining the ABM Treaty environment because the maintenance of the ABM Treaty is in the interest of U.S. security. Abolition of the ABM Treaty would give the Soviets the chance to deploy a nation-wide ABM System long before we could. As indicated above, we could overcome such a Soviet defense and might eventually respond with a better ballistic missile defense of our own, but we would have to expand our offensive forces, and the resulting strategic situation would, in my judgment, be both less certain and more dangerous than that prevailing in a situation where the ABM Treaty exists and is observed.

QUESTIONS SUBMITTED BY SENATOR HOLLINGS

(Questions answered by Dr. Harold Brown)

Question. There is no doubt that U.S. negotiators wanted a ban on future exotic ABM systems and components. Equally certain is the Soviet refusal not to prohibit unknown devices. A very thorough search of the negotiation record does not reveal the Soviets ever backing off from this position. As a matter of fact, U.S. negotiators finally conceded that future systems would be handled elsewhere, and the two sides worked out Agreed Statement (D).

Your testimony suggests the Soviets receded on this matter. Can you suggest a date when this happened or perhaps some material that shows the Soviet concession?

Answer. My memory does not accord with your account of events at the ABM Treaty negotiations. Because the Reagan Administration has declined to allow any of the then negotiators not now in the government to examine the record, I find it difficult to answer your question. I do recollect seeing at the time a memorandum of conversation between Mr. Greybeal, who was negotiating this matter for the U.S., and the Soviet negotiator Karpov, which stated that Karpov accepted the U.S. position as regards the ban on the development and testing of systems or components based other than at fixed sites on land. To me, Article 5, paragraph 1, seems rather clear: "each party undertakes not to develop, test, or deploy ABM systems or components which are sea-based, air-based, space-based, or mobile land-based."

Question. Have you always held the view that the Soviets firmly agreed that future exotic ABM systems were banned by the Treaty? Have you ever expressed -- orally or in written form -- that there may be some doubt about the Soviet's interpretation of Agreed Statement (D) in comparison to ours?

Answer. I believe, as I stated in my testimony before the Committee, that there has been some ambiguity about the Soviet position on future exotic ABM systems. Clearly, they agreed that the treaty banned the deployment of such systems unless the treaty were subsequently amended to allow such deployment. With respect to development and testing, there is material in the record of the negotiations that supports each interpretation. In my judgment, the overall balance of the evidence of the negotiations, as well as the text of the treaty itself and the practices of the two sides, support the traditional or narrow interpretation. As indicated above, I do not have access to the negotiating record nor to documents I may have written while in the government; the Reagan Administration has chosen not to respond to my requests to examine those documents, including the ones I wrote myself. I would not be surprised to find that upon occasion I had indicated that the Soviet interpretation of the ABM Treaty differed on various counts from that of the U.S. Clearly, the Soviets have pushed up to the edge in matters of testing in an ABM mode and, in the case of the Krasnoyarsk radar, they have pushed over the edge.

Question. Are the words "fixed, land-based ABM systems" used in Agreed Statement (D)? Like you, some, but not all, of the U.S. ABM Treaty negotiators say those are the systems intended to be covered by Agreed Statement (D). Why didn't you put those words in Statement (D)? If the negotiation record does not say that Agreed Statement (D) is limited to fixed, land-based systems, how would you interpret the term "ABM systems based on other physical principles"?

Answer. No, the words "fixed, land-based ABM systems" are not used in statement D. Nor are they used in Article 5, which bans the development, testing or deployment of ABM systems or components that are anything but fixed and land-based. The characterizations as to locale or mobility are not in Agreed Statement D because they are covered in Article 5.

I would interpret ABM systems based on other physical principles as applying to systems using directed-energy weapons rather than interceptors; those were the examples of futuristic systems that we and the Soviets used in discussions during the ABM Treaty negotiations.

To the best of my recollection, those negotiations were consistent with what the Treaty says on its face, as follows: ABM systems for a defense of the territory of either country, or the provision of a base for such a defense, are not allowed except as provided in Article 3. Article 3 describes what is allowed, including numerically and geographically limited fixed land-based systems. Article 5, Paragraph 1, forbids development, testing or deployment of other than fixed land-based ABMs. Agreed Statement D explains how systems based on other physical principles and including components capable of substituting for missiles, launchers, or radars would count ("specific limitations on such systems and their components") in substituting for the numerically limited deployments described in Article 3.

Question. I would like to point out that none of Gerard Smith's testimony limited Agreed Statement (D) to fixed, land-based systems. Further, he cited the only prohibition to future exotics was on the deployment of such systems. Any comments?

Answer. Article 3 takes care of limiting Agreed Statement D to fixed land-based systems. Because development and testing of "ABM systems based on other physical principles" is allowed for fixed, land-based systems, there is no need to describe the prohibitions on such systems except in terms of deployment.

Question. Why did it take the Soviets nearly two years after the President's SDI speech in 1983 to declare that such a program would violate the ABM Treaty? In that interim period, why did the Soviets stress the need for a new treaty to ban defensive weapons in space?

Answer. I do not profess to read the minds of the Soviet leadership, which was changing rapidly during the period to which you refer. I would note, however, that, since the President's SDI speech in 1983 implied deployment as well as development of a strategic defense (though deployment as a policy has disappeared and reappeared several times), the most far-reaching violation of the treaty would be in the deployment. The ABM Treaty does not ban ASAT weapons; you may be referring to the discussion of that issue, which the Soviets have indeed pressed. Some ASAT weapons may have a marginal ABM capability, so that the two questions do interact.

Question. Is the U.S. unilaterally bound to provisions it believes are required by a treaty if the Soviets have a different interpretation and act accordingly?

Answer. The U.S. should abide by provisions it believes are required by the treaty, and it should insist that the Soviets abide by them. If the Soviets fail to abide by them, the United States is at liberty to declare the treaty void, if it believes its national security interests are served by such an action.

QUESTIONS SUBMITTED BY SENATOR BYRD

(Questions answered by Dr. Harold Brown)

Question. The Strategic Defense Initiative (SDI) has been under way for some three years now. Spending for SDI research has increased significantly each year, although less than the Administration has requested.

Recently, there has been much discussion and debate about "early deployment" of SDI. That is, many SDI proponents contend that SDI research results have been impressive, and that a decision should now be made as to whether to proceed ahead with deployment of SDI technologies.

While no decision has been made, SDI and other officials have suggested that an early deployment system would include ground-based interceptor missiles and hundreds of space-based platforms carrying thousands of kinetic kill vehicles. SDI proponents contend that such a system could be deployed in about ten years, be relatively inexpensive, and be very effective against Soviet missiles and warheads.

What are the advantages for U.S. security in early deployment of SDI? What do you see as the disadvantages of early deployment?

Answer. An early deployment of SDI by the U.S., if it were unilateral, would complicate Soviet strategic offensive force planning and could make it more difficult for the Soviets to preemptively attack U.S. strategic retaliatory forces. On the other hand, the Soviets could at considerably lesser cost than the cost of the U.S. deployment negate such U.S. goals. The Soviets could deploy a ground-based ABM system before the U.S. could deploy either a ground-based system or a primitive space-based system. The U.S. would undoubtedly see such a Soviet deployment as dangerous to the U.S. strategy of deterrence and would have to respond by extensive modifications to U.S. strategic offensive forces. The resulting uncertainty about the effectiveness of each other's defensive forces and of one's own offensive forces would, in my judgment, intensify the arms competition, decrease stability (although not fatally) and worsen the political situation. Effects on U.S. alliance relationships and U.S. domestic cohesion on foreign and defense policy questions would also be adverse.

Question. What do you believe would be the military significance of the systems being discussed and considered for early deployment? How effective would such systems be in protecting civil populations and industry?

Answer. I do not believe that the systems being discussed and considered for early deployment would improve the U.S. military situation in the light of likely and feasible and affordable Soviet responses. Unless our intercontinental ballistic missile force were rebased in a mobile or multiple protective shelter mode, even the easier goal of improving their survivability by use of a defensive ABM overlay would not be achieved; the Soviet responses of saturation, exhaustion, or penetration by use of decoys would overcome such defenses at a lower cost to the Soviets than the U.S. cost of defenses. The systems being discussed and considered for early deployment would be completely ineffective in protecting civil populations and industry against an attack by an arsenal of anything like the size of that possessed by the Soviets.

Question. What would be the likely Soviet responses to early deployment? How would those responses affect the long-term survivability of an early deployment system?

Answer. The likely Soviet responses to an early deployment include an increase in the number of their ballistic missile warheads, the development and deployment of fast-burn boosters both in ICBMs and for use in a direct attack on the space-based components of the defensive system, and the development of decoys for mid-course and high endoatmospheric penetration. Those responses would undercut the effectiveness of the system at a lower cost to the Soviets than the cost of the defensive system. They would also make the space-based components of the defensive system incapable of survival of a direct Soviet attack on it, if the Soviets chose defense suppression rather than penetration as their tactic.

QUESTIONS SUBMITTED BY SENATOR KASTEN

(Questions answered by Dr. Harold Brown)

Question. It is my understanding that the Soviets may build intercontinental ballistic decoys and use fast-burn ICBMs to address the threat of kinetic kill vehicles. If the fast-burn ICBMs are used by the Soviets, I am told we would have to increase our planned kinetic kill vehicles by a factor of 25. How do you see the Soviets addressing this threat?

Answer. I believe that the Soviets can at modest cost and weight penalty build decoys to accompany the warheads of their ballistic missiles so as to penetrate a mid-course intercept tier of a strategic defense. They can similarly develop and build fast-burn ICBMs to penetrate the boost-phase intercept tier of a strategic defense system. The latter would be particularly effective against space-based kinetic kill vehicles; depending on the design of the fast-burn booster and of the KKVs, a factor of ten or more increase in the size of the KKV tier could easily be required. I believe that the Soviets could develop and deploy such decoys and fast-burn ICBMs by 1995 or earlier. They would have to alter their present development program for the generation of ballistic missiles following that of the SS-24s and SS-25s, but they could do so, in my judgment, much more easily than we could develop and deploy even a relatively ineffective three-tier strategic defense system by the mid-1990s. I would expect that the Soviets are already beginning development along these lines as a matter of prudence.

QUESTIONS SUBMITTED BY CHAIRMAN STENNIS

(Questions answered by Dr. George Miller)

1S. You indicate there are risks in deciding early deployment before we know enough about the technological capabilities of more future-oriented defenses and about related policy options. Are you concerned that funding allocations necessary for early deployment could undercut efforts to obtain this information?

What, specifically, are these risks, and what do they mean in terms of the cost-effectiveness, survivability, and military effectiveness of various SDI systems?

One must always be concerned about prioritization of national defense investments in a funding constrained environment. Because there are many other defense needs in addition to those of the SDI program, it seems plausible that procurement costs to support deployment would come to some extent at the expense of the research program unless additional funds were to be made available. The issue is one of determining the proper timing of exercising a deployment decision and continuing to acquire information necessary to make a deployment decision. It is important to note that a continuing research program will always be needed, even after a deployment decision is made. Such an effort provides the technology to ensure a continuing capability against a potentially evolving threat.

Historically, the strategic balance has been maintained in a dynamic competition between actions or measures by one side and reactions or countermeasures by the other side. It is important to consider several iterations of the possible moves and counters in maintaining the balance. The risks of a premature decision to deploy defenses include starting down a strategic policy path which does not provide enhanced national security in the long run, but merely escalates the arms race and results in a less secure, less stable environment. The principal danger in proceeding with deployment before assurance of more effective follow-on systems lies in the richness of the potential Soviet countermeasures to the early system. These seem to be timely, technologically feasible and possibly quite effective against defensive systems based on only presently "mature" technologies. Defensive responses to these potential countermeasures relying on the "mature" technologies do not prove, in our estimates, to be marginally cost effective, at least for general area defense schemes. More future-oriented defense technologies may prove to be much less susceptible to these countermeasures, and could thereby provide the means to respond to the first round of countermeasures with a marginally cost-effective upgrade of the previously deployed system.

The military effectiveness of various levels of defense performance depends on the military missions thought to support the national policy of strategic deterrence. A recent SDI study has identified a variety of militarily useful missions which could be accomplished by a less-than-perfect defense. Such a defensive system could, through preferential defense of some critical national assets, provide considerable strategic leverage. While there may be other, more immediately cost-effective means of achieving the same or equivalent leverage, the tradeoffs between the various approaches should include the potential long-term advantage thought to accompany defenses whose performance could be enhanced by follow-on advanced technology concepts. Our studies of the performance potential of proposed near term deployments identified effective countermeasures which could lead to delivery of more than 80% of the threat on targets not selected for preferential defense. Later, responsive threat designs would be even more effective in penetration unless the defense were capable of fielding more capable weapon concepts. It is essential for the research program to establish with confidence that follow-on technologies will be available to maintain defense effectiveness even in the face of responsively designed offensive threats. This, in my opinion, is an essential ingredient of the early 1990's decision milestone.

2S. Do these proposed fiscal 1988/89 budgets contain the correct emphasis with respect to resolving the remaining, most critical scientific and technological challenges?

I have not analyzed the proposed FY1988/89 SDI budget requests in great detail. There have been significant shifts in the funding profiles for the various elements of the program since its initiation in 1984. While it is appropriate and important to continually monitor the progress of various elements and change emphasis and priorities as developments occur, major shifts due to budget cuts and radical change in program strategy can be very debilitating on a high technology research program; a stable planning environment is very important. While the program based on the President's budget appears to be generally consistent with a plan to resolve the major physics and technology issues by the mid-1990's, my main concern is whether balance can be maintained in the program after congressionally-approved budget reductions occur. Of particular concern is a stable environment for the important longer-term technologies and necessarily expensive major integration experiments for these technologies. I continue to believe that preparation for the early 1990's decision milestone warrants investments in research to increase our understanding of the limitations on performance and survivability of both the technically mature options and the follow-on advanced technology concepts.

3S. One of the three major criteria for judging SDI systems is whether they are cost-effective at the margin--that is, can they counter efforts to defeat them less expensively than the cost to the Soviets to mount those efforts. Your laboratory is active in this area. You have indicated that early deployment systems being considered do not pass this important test. Why, and what are the implications of such an assessment for the current orientation of the SDI program as proposed in this budget?

The marginal cost effectiveness of near term defenses cannot be evaluated with great certainty at this time. Our studies have focused on highly effective defense architectures instead of imperfect defenses with limited military missions. For these cases, our work suggests that it would be cheaper to counter these defenses than to buy them.

This conclusion is based on a recent study in which we considered several ways in which the Soviets might respond to a near term defense deployment. The most effective modernization techniques were to modify the post boost vehicles for MIRVed missiles to permit rapid RV deployment, to add light weight RV decoys, and to reduce solid fuel booster burn time somewhat by changing the fuel composition. These modifications do not require high levels of technology, and could perhaps be accomplished concurrently with deployment of the near term U.S. defense.

If we assume that Soviet costs are the same as costs of comparable missiles to the U.S., and use current estimates of near term defense costs, we find that procurement costs for the defense would be signifiantly larger than for the defense. This is true even though in our scenario the defense has very little capability against the modernized offense, and even though much of the proposed offensive force modernization (without the simultaneous deployment or decoys) would probably occur even without U.S. defense, i.e., most of the Soviet costs may already be in their budget. Current estimates of cost ratios are highly uncertain: defensive weapon costs are hard to estimate because these systems are large, complex and in a very early stage of development. Soviet weapons costs are not accurately known either, and it is difficult to compare costs between two such different economic and political systems.

Follow-on, advanced technology concepts which are robust to the near term countermeasures might provide marginally cost effective upgrades to the near term defense. The availability, performance limitation and survivability of these concepts are essential ingredients of the early 1990's decision milestone.

4S. Do you believe that the early deployment defenses being contemplated by the SDI program meet the other two main criteria endorsed by the Executive Branch and the Congress--that they be militarily effective and that they be survivable?

While the marginal effectiveness of a defense is determined by its performance against responsive threat elements, the total effectiveness is determined by the integrated composition of the threat at a given time, which will be a mix of responsive and older systems. The composition of the Soviet threat in the mid-to-late 1990s is rather uncertain, but it may still contain some number of older, highly MIRVed, liquid fueled ICBMs like the SS-18s; newer MIRVed solid fuel missiles such as the SS-24; relatively fast-burning ICBMs with few warheads, such as the SS-25, and follow-on systems deployed as a response. Kinetic kill vehicles are in principle quite capable against the SS-18 in boost phase and against SS-24 during its deployment phase, but have little capability against SS-25 or against MIRVed solid fuel missiles with fast-deployment post boost vehicles. The key to defense effectiveness at any time is then clearly the rate at which responsive force modernization proceeds and the rate at which advanced defensive weapons can be fielded as a counter response. Our studies indicate that major offensive force modernization appears plausible in the mid-90's, and that this modernization would be very effective against defenses proposed for that time frame and somewhat later.

The survivability of strategic defenses to direct attack must be considered as part of the more general issue of robustness to a wide variety of possible Soviet countermeasures. As to the specific question, however, it appears that once a sufficiently large defense has been established, it may be robust against the particular strategy of a sudden attack of selected assets as a precursor to an ICBM attack. This is achieved by a combination of proliferation (many carrier vehicles), hardening to a moderate level against nuclear and laser effects, and maneuver. The effectiveness of direct ASAT attacks is related directly to the implementation of other offensive responses which reduce the number of participating defensive platforms. However, the survivability of the defense to attack in the early phases of deployment or to gradual attrition are essential issues to be addressed before the 1990s decision milestone.

5S. In your own personal, professional judgment, when do you think the SDI program will yield sufficient technical data with prudent confidence levels which would support a sound evaluation -- on scientific, technological, engineering and cost-effectiveness bases -- of the feasibility of defensive technologies to contribute in a meaningful way to U.S. national security objectives? How many more years of research are needed before the nation can decide about the feasibility and cost effectiveness of the early deployment SDI systems and of the more future-oriented SDI systems?

The program plan established by the Defensive Technologies Study Team and executed by the SDIO called for a decision milestone in the early 1990's. No shorter period and no more specific decision milestone date were established because of the challenging scientific research and stressing technological advances which would be necessary to support an informed decision. Impressive progress in the research programs has been made, and significant advances in supporting technologies have been demonstrated. Much, however, remains to be done. The research programs for example, have succeeded in demonstrating, in principle, the essential underlying concepts of many of the directed energy options, but important physics issues remain to be resolved before weapon-level performance can be assured. Similarly, many supporting technology elements have been separately tested in important, well-defined experiments, but integrated systems concepts are not yet mature enough to support the costing or survivability studies essential to cost-effectiveness and survivability assessments. Given adequate funding, the original decision milestone date in the early 1990's still appears reasonable, both in light of what has been done and in terms of what is yet to be accomplished.

The decision regarding initial deployment of SDI systems seems to me to hinge on the feasibility of follow-on systems responsive to the potential countermeasures to which early deployment systems are susceptible. The feasibility of some follow-on systems should be determined before the decision milestone date is reached. Other far-term technology options will likely require significantly longer research periods before their technical feasibility can be established. Continuing research efforts in these far-term technology options is essential to maintain an ability to respond effectively to countermeasure research and development.

6S. Do you personally, professionally believe that an early-1990s milestone date for deciding the feasibility of SDI missile defenses can be met, especially for the more advanced and innovative concepts being explored in the program, but also for the more mature concepts, such as space-based and ground-based kinetic energy weapons?

Assuming adequate and stable funding, I think the early 1990's decision milestone provides a well-conceived period in which to explore the technical feasibility, the survivability and the cost-effectiveness of some of the technology options which would support an effective strategic defense. Other technical options will surely require a longer period of investigation before decisions regarding their utility could be made.

Indeed, some of these future options may not have even been identified yet. A continuing research program in far-term, innovative concepts is consistent with maintaining robust capability in the dynamic iteration between defensive deployments and offensive countermeasures. With regard to the more mature concepts, I think the essential issues are developing integrated system concepts for supporting both survivability and cost-effectiveness assessments and identifying follow-on technology options which effectively counter offensive developments to which the early deployment systems are susceptible. Again assuming adequate and stable funding, I think the early 1990's milestone date provides adequate time for these requirements to be met.

7S. Referring to possible space-based, near term defensive systems, you state "very important feasibility experiments have been successful, but these are a long way from system validation." What are the critical technology tasks remaining, what level of risk does each involve, and when, in your personal, professional opinion will the system validation point be reached?

For the near term defensive concepts, some of the critical issues which remain to be demonstrated are

1. Affordable heavy lift capability.
2. Achievable mass reduction of the SBKKV interceptor and its booster system.
3. Demonstration of acquisition, tracking and target intercept ability in a possibly disturbed environment.
4. Demonstration of shrouded target acquisition and intercept ability.
5. Demonstration of discrimination technology adequate to allow target discrimination from other space objects including both debris and purposeful decoys.
6. Demonstration of C^3I battle management capability to direct the complex engagement at an acceptable level of resilience to error.
7. Integrated system architecture definition adequate to support survivability and cost effectiveness assessments.
8. Identification of follow-on technology options which would be responsively effective against the suite of possible countermeasures and which could confidently be deployed so as to provide marginally cost effective upgrades to the earlier system deployment.

Some degree of technical risk accompanies all of the above tasks, and it is difficult to define an appropriate and consistent scale of relative risk for these disparate efforts. However, in my opinion, the greatest risk should be associated with items 5, 6, 7 and 8. This view of system validation requirements calls for a completion of those tasks associated with achieving the early 1990's decision milestone. I think this remains a reasonable goal provided adequate and stable funding for the SDI program can be maintained.

8S. You refer to the remaining theoretical, engineering and experimental developments required to demonstrate propagation of a laser beam through the atmosphere at high power. You say all the laser

> technologies being considered for SDI require such efforts to varying degrees. Please elaborate, and, for each of the laser technologies, provide the key, critical efforts in each of these categories which must be successfully accomplished, the degree of risk to accomplishing each, and the timetable by which Congress reasonably could expect each to be accomplished successfully.

The three major phenomenological issues in propagation relate to turbulence, thermal blooming, and stimulated Raman scattering (SRS). SRS is a phenomenon in which nitrogen molecules in the atmosphere are excited by the beam, causing the beam to decrease slightly in energy. At high intensities, this effect can cause the beam to diverge rapidly, preventing propagation. All these problems are potentially important for ground based lasers. They are present, but less severe, for space based systems, whose beams never pass through the thickest part of the atmosphere and are not pulsed, which reduces SRS. (Space based systems do, however, have optical and engineering problems not shared by ground based lasers.) It has been demonstrated that successful correction for turbulence at low power can be obtained. The advent of high power lasers produces the coupled effects of turbulence and thermal blooming. Current computational models have been unable to resolve whether correction can be obtained under the conditions relevant to ballistic missile defense with ground-based lasers. While theoretical research must continue in this area, it is clear that experiments must be performed. Therefore, The Army's Ground-Based Free Electron Laser Technology Integration Experiment (GBFEL TIE), planned for the early 1990's, represents the key test of this phenomenology. It not only represents a test of our ability to assemble into a system all of the elements of a ground-based laser, but provides crucial data on atmospheric propagation and coupling of laser radiation to materials. The results of tests on thermal blooming affect all ground-based laser concepts. In addition, SRS affects pulsed laser concepts like excimers and induction FELs. These laser concepts are attractive because of the possibility of enhanced lethality against target materials associated with boosters and for interactive discrimination. Because of their higher peak power, however, they must be designed so as to respect the peak irradiance limits imposed by SRS. Therefore, detailed understanding of these limits must be obtained, as will be the case for the GBFEL TIE. Current plans should allow resolution of these issues by the mid-1990's. Risks associated with resolution of the thermal blooming issue must be assessed as high at this point. Risks associated with resolution of the SRS issue are assessed as low at this time, in that a significant number of design options exist to accommodate this phenomenon.

9S. What are the remaining critical tasks which must be successfully completed to fully assess and then actually demonstrate the performance required for an x-ray laser counterdefense weapon and demonstrate the improved performance which could provide an x-ray laser defense against current or responsively designed Soviet missiles? What degree of risk is embodied in each critical task?

The XRL program has a near term goal of demonstrating feasibility of a weapon whose brilliance is consistent with requirements for a ground based, pop-up counterdefensive weapon. These requirements are significantly less than those for a defensive weapon capable of interdicting either current or responsively - designed missiles. The near term feasibility demonstration is considered to be a necessary milestone along the path to the more capable anti-missile defensive weapon, although an advanced engineering development program based specifically on this near term capability is not necessarily required.

The critical tasks associated with both classes of mission can be separated into nuclear and laser device performance, and supporting weapon platform functions. Of the latter, the most stressing appears to be the acquisition, tracking, and pointing (ATP) system development. The SDIO through its agent, the U.S. Army Strategic Defense Command in Huntsville, is currently supporting a program designed to develop ATP requirements and define an appropriate test program. Critical tasks include:

1. Demonstration of required boresight accuracy of the laser medium and maintenance of this accuracy during the nuclear explosion.

2. Design and construction of a capable acquisition and tracking sensor system which is consistent with platform weight and volume constraints and with laser divergence and weapon range.

3. Development of high confidence algorithms for relating sensor observables to pointing of the laser beam(s).

In general, these tasks are expected to be more difficult for a multi-beam defensive weapon than for a counterdefensive weapon which is likely to have only a single beam. These tasks for the counterdefensive and second generation defensive weapons appear to be within the current state-of-the-art.

Development of the x-ray laser itself will proceed through several phases: fundamental physics experiments, laser physics characterization, laser systems design, and weaponization. All of these phases will co-exist and be properly scheduled in the experimental program. This program includes laser physics underground nuclear tests, source development tests, and relevant laboratory experiments, whenever possible, to provide the data necessary for validation of these approaches and their development into a demonstration of technology integration.

10S. Do nuclear-driven directed energy weapons, especially the x-ray laser, have more potential as part of a U.S. missile defense system or as a countermeasure to Soviet missile defenses? What percent of the budget resources assigned by the Department of Defense and the department of Energy are allocated for each purpose in the FY 88-92 budgets? Please provide annual data based on current and constant (fiscal 1988) dollars.

The U.S. x-ray laser program has the dual objectives of assessing the counterdefense threat posed by near term XRL weapons and of understanding possible roles for an XRL as one element of a strategic defense deployment. As discussed above, the requirements for a counterdefense weapon appear to be significantly less than those for an anti-missile defensive weapon. The time scale for reaching this performance level is therefore shorter, and the associated technical risk is lower (although still challenging). A second generation XRL does appear to have considerable potential for strategic defense. If weapon performance goals can be achieved, the weapon could be ground or sea-based and still be highly capable against ICBMs similar to modern, current generation Soviet boosters and against SLBMs as well. Space basing is also a possibility that could be attractive due to the light weight of the XRL platform, its long range, and its ability to provide parallel kills of multiple boosters, even fast burning types. Other SDI missions such as RV kill from a CONUS-based system may also be appropriate for an XRL.

The FY88-92 budgets for XRL technology development do not formally distinguish among the mission applications in terms of fraction of support. Since the near term XRL device performance goal consistent with counterdefense requirements is viewed as a necessary milestone along the development path for a defensive weapon, no distinction is possible at this time. For the supporting technology development, the SDI ATP program is directed chiefly toward the defensive weapon development, with perhaps 15% specifically directed toward the counterdefense mission. Much information gained in the defensive weapon portion of this program will of course be directly relevant to counterdefense assessments. Systems analysis at the level of about $300K/year is directed specifically at the counterdefense mission; this represents about 20% of DOE systems analysis effort in the XRL program. The supporting technology development and systems analysis, however, represent a small fraction of the total XRL program since the major technological uncertainties are in the weapon performance. Thus, the majority of the XRL technology development program is directed toward understanding the potential of counterdefensive concepts at this time.

QUESTIONS SUBMITTED BY SENATOR PROXMIRE

(Questions answered by Dr. George Miller)

1P. Why are we seeing this push within the Defense Department and among SDI's more avid proponents for a near term SDI deployment? In the draft testimony you submitted to the Subcommittee last week, you said the reason is because people want tangible results out of the program and because we do have some relatively mature SDI technologies on the drawing boards. Is this movement toward a near term deployment motivated by a desire to politically cement the program?

There may be many reasons within DOD and among SDI supporters for seeking early deployment of a defensive system. One good reason for performing a planning study of deployment is to develop an awareness of the scope of the undertaking and to assure that all system and support requirements either have been met or are being addressed. In addition, a recent SDI study has identified a variety of militarily useful missions which could be accomplished by a less-than-perfect defense. Such a system could support preferential defense of some critical national assets, providing considerable strategic leverage. This approach to defense could perhaps be achieved using mature technology concepts like those being developed in the Kinetic Energy Weapons program. While there may be other, possibly more immediately cost-effective means of achieving the same or equivalent strategic leverage, the trade-offs between the various approaches should include the potential long-term advantage thought to accompany defenses whose performance potential could be enhanced by follow-on advanced technology concepts. I continue to support an SDI research program that establishes the performance potential and survivability of these follow-on technologies in order to support the decision milestone in the early 1990's.

2P. You mentioned that there are "significant risks" to proceeding with an early deployment before we have the "full range of technology and policy options" to support such a decision. Can you describe what those risks are?

Historically, the strategic balance has been maintained in a dynamic competition between actions or measures by one side and reactions or countermeasures by the other side. It is important to consider several iterations of the possible moves and counters in maintaining the balance. The risks of a premature decision to deploy defenses include starting down a strategic policy path which does not provide enhanced national security in the long run, but merely escalates the arms race and results in a less secure, less stable environment. The principal danger in proceeding with deployment before assurance of more effective follow-on systems lies in the richness of the potential Soviet countermeasures to the early system. These seem to be timely, technologically feasible and possibly quite effective against defensive systems based on only presently "mature" technologies. Defensive responses to these potential countermeasures relying on the "mature" technologies do not prove, in our estimates, to be marginally cost effective, at least for general area defense schemes. More future-oriented defense technologies may prove to be much less susceptible to these countermeasures, and could thereby provide the means to respond to the first round of countermeasures with a marginally cost-effective upgrade of the previously deployed system.

3P. You mentioned in your draft testimony that you are "concerned that funding allocations necessary to support early deployment could diminish support for the required research program." In other words, are you saying that if we launch an early deployment all our resources might be poured into a near term deployment with no money left over for the basic and advanced SDI research?

One must always be concerned about prioritization of national defense investments in a funding constrained environment. Because there are many other defense needs in addition to those of the SDI program, it seems plausible that procurement costs to support deployment would come to some extent at the expense of the research program unless additional funds were to be made available. The issue is one of determining the proper timing of exercising a deployment decision and continuing to acquire information necessary to make a deployment decision. It is important to note that a continuing research program will always be needed, even after a deployment decision is made. Such an effort provides the technology to ensure a continuing capability against a potentially evolving threat.

4P. What kind of security risk do we run if a near term deployment consumes all our resources and the follow-on technology research gets shortchanged? In other words, what happens if we put up strategic defenses early but then have no follow-on technologies coming on line to ensure that those defenses remain survivable and effective?

Historically, the strategic balance has been maintained in a dynamic competition between actions or measures by one side and reactions or countermeasures by the other side. It is important to consider several iterations of the possible moves and counters in maintaining the balance. The risks of a premature decision to deploy defenses include starting down a strategic policy path which does not provide enhanced national security in the long run, but merely escalates the arms race and results in a less secure, less stable environment. The principal danger in proceeding with deployment before assurance of more effective follow-on systems lies in the richness of the potential Soviet countermeasures to the early system. These seem to be timely, technologically feasible and possibly quite effective against defensive systems based on only presently "mature" technologies. Defensive responses to these potential countermeasures relying on the "mature" technologies do not prove, in our estimates, to be marginally cost effective, at least for general area defense schemes. More future-oriented defense technologies may prove to be much less susceptible to these countermeasures, and could thereby provide the means to respond to the first round of countermeasures with a marginally cost-effective upgrade of the previously deployed system.

The consequences of a defense deployment in the absence of follow-on technologies should not be evaluated in isolation. For example, if the U.S. continued with the strategic modernization program in addition to defense deployments, a negation of the defense might leave the basis of deterrence largely unchanged from the current situation if there are no major Soviet initiatives. This situation is unlikely in my opinion.

5P. Dr. Miller, you mentioned the progress your lab has made with the free electron laser. Nevertheless do we know for sure at this point that a militarily effective, survivable, and cost effective laser can be built?

At this time, we have a fairly complete understanding of the technological and cost goals for the FEL technology that would result in achieving all of the requirements for a useful BMD system. We have only partially completed the research that must be performed in order to address the issues of feasibility of a militarily effective, survivable and cost effective weapon. Survivability must be addressed up front and its costs included in exchange calculations. We are in the early stages of analyzing all of these effects in a coordinated fashion. It is our view that sufficient understanding of these issues must be gained before commitment to phased deployment, since some form of directed energy defense must be made viable as a technical option in order to influence Soviet responses to U.S. deployment of defenses. In order to "know for sure", we must complete the basic physics and technology demonstrations for the FEL, resolve the issues related to the phenomenologies of atmospheric propagation and target coupling, and perform sufficient costing and systems analysis to convince ourselves that such a defense will not be easily overcome by Soviet offensive or counterdefensive responses.

6P. Such a laser would be follow-on technology that would be deployed as the effectiveness of the initial deployment of space-based kinetic kill vehicles degrades. Do we know at this point whether we can deploy these follow-on technologies?.

See response to 5P.

Ground-based laser deployments could possibly be used to shore up the weaknesses of the KEW defenses if the Soviets were to choose large decoy suites or fast burn boosters as countermeasures to the defense. Early KEW deployments with significant amounts of leakage can be assisted by the initial deployment of a few GBL links as decoy suites increase in size and complexity. In this role, the lasers could perform interactive discrimination in selected threat tubes in support of the KEWs. This form of preferential defense could restore capability to the defense, potentially with acceptable cost exchange. Responsive boosters would require that the laser defense assume prime responsibility for boost phase and would imply the deployment of more laser links of increased capability and with fighting mirror ground tracks over the USSR in low earth orbit. At that point, all of the issues of survivability and relative cost would need to be fully resolved. We are at least a decade away from being able to confidently project the capability of ground-based laser links in this scenario. Therefore, deployment of laser defenses cannot be committed for FSED in the near future and it can be argued that the KEW deployments cannot be committed until a clear path can be envisioned for handling (and influencing) possible Soviet responses.

7P. Should we begin an early SDI deployment before we know whether the follow-on technologies will be available so the defense will continue to be effective?

As I stated in my testimony, SDI deployment should not proceed until we have technical assurances that defenses will provide a long term stable future for the U.S. In my opinion, the research into the longer term technologies is necessary to provide the technologies which may result in a stable defense based posture, but a deployment decision should wait until we have proven the viability of follow-on advanced technologies capable of providing marginally effective responses to the possible range of Soviet countermeasures.

8P. You mention in your statement that if we begin a near term deployment, some studies have shown that there are countermeasures the Soviets might have ready as we begin erecting these defenses. What are these countermeasures?

Proliferation of the SS-25 may begin immediately. As mobile SS-24s are introduced, they may be geographically concentrated to saturate defenses. Targeting strategies and operational procedures may be revised to permit nearly simultaneous ICBM launch and to concentrate the threat during deployment. Modifications in threat deployment procedures can reduce deployment timelines. SS-25s could be targeted for a precursor attack on ground SDI assets. SS-25s or smaller missiles such as the SS-20 could be modified to be used as direct-ascent nuclear ASATs. RVs could be modified to salvage fuze during midcourse intercept.

After a few years for development and flight test, very light balloon decoys may be deployed. A replica decoy could be developed for terminal penetration. Reentry vehicles could be enshrouded or encapsulated to confound discrimination. Boosters could be retrofit with new propellant and nozzles to reduce burn time. Structural changes may be made to post-boost vehicles to permit rapid deployment of MIRVs. A homing ASAT might be developed.

Follow on SDI technologies have the potential to perform at levels which may make the defense significantly less sensitive to such countermeasures.

9P. You mention in your original draft testimony that the Soviet Union "has the potential" to develop an "entry-level" x-ray laser in the mid to late 1990's that could threaten our space-based sensors. Are you saying that by the time we got a near term deployment in place, the Soviets could have developed a crude x-ray laser that could pose a serious threat to that defense?

The perception of Soviet potential to develop an x-ray laser is based on demonstrated laser performance in U.S. tests and on scientific publications in the USSR. Open literature publications by competent Soviet scientists dating back to the early 1970's reveal a knowledge and interest in x-ray lasing and related physical phenomena. At the time, Soviet scientists had claimed a record for short wavelength lasing (close to the x-ray part of the electromagnetic spectrum). The claim was soon retracted and the Soviets subsequently said they could not reproduce the earlier result. Their publications did not specifically discuss nuclear explosive pumped x-ray lasers but scaling laws were presented that showed that they understood the power levels that are required for x-ray lasing. In the early 1980's the Soviets did respond to a short article in Aviation Week that mentioned an alleged U.S. x-ray laser test. The Soviet article proposed their own design for this reported U.S. x-ray laser. In the past few years senior Soviet scientific spokesmen, including Academician Y. P. Velikhov and R. Z. Sagdeev, have given detailed reasons why x-ray lasers would be ineffective or could be easily countered. The technical reports and statements made by the Soviets to date do not indicate the status or goals of a possible Soviet x-ray laser program.

10P. You mention in your testimony that an early deployment of space-based kinetic kill vehicles and ground-based ERIS interceptors "could not be accomplished on schedule with a business-as-usual approach." Are you saying that if we wanted to have a near term deployment, we'd have to launch a crash program like a Manhattan Project to accomplish it?

At the peak of this country's ability to launch satellites (1964), we placed in orbit a total of 100 objects of a total mass much less than 100 tons. At that time, 400,000 people were employed in the space industry. As of 1984 only 134,000 people were employed in the space or related fields. Optimistic projections consider a million people to be the minimum support required to launch 8000 tons into orbit. The length of time it would require to identify, train and motivate a large scale workforce may prove to be a significant bottleneck to early deployment.

Launch vehicle requirements for placing SBKKVs in orbit are also very stressing. Our limited inventory of Delta, Titan and Atlas rockets is capable of placing less than 10 percent of the required architecture in orbit. Suggested boosters of large capacity such as the Heavy Lift Launch Vehicle (HLLV) and the Shuttle Derived Launcher would be capable of partially bridging the gap.

The launch support infrastructure which would be required is quite stressing in the near term. Presently, Vandenberg Air Force Base is only launch site available for directly placing satellites into the polar orbits required for SDI. To convert VAFB into a Shuttle-capable facility has required seven years and four billion dollars. But to achieve a total launch rate of thirty boosters per year for ten years with each site launching one every six weeks (the best Shuttle turnaround realized on a crash basis) would require at least four such facilities (five if continuous refurbishment became a requirement). An alternative might be to use the Kennedy facility to place a satellite in equatorial orbit and then maneuver it into a polar orbit, but this would reduce the total mass to orbit by at least a factor of two for given fleet size.

The network of tracking and data relay satellites required to establish each of the carrier vehicle orbits will also be traffic limited. This network must be augmented to support deployment. But currently our capability of placing TDRS satellites in orbit is sidelined along with the Shuttle program.

Finally, mass production of the KKVs, ERIS and their components may be a difficult task. Individual items made in the past by almost custom-designed techniques must be adapted to a production line mode. Careful attention would be required to assure quality and obtain the expected economies of scale.

11P. In your opinion, has there been any new threat posed by the Soviet Union in the past year that would prompt this nation to launch a crash program to deploy strategic defenses early?

In my opinion, the steadily evolving Soviet threat in offensive force modernization and growth as well as the long-standing Soviet "SDI" research program warrant continued significant and stable investments in similar U.S. programs of force modernization and strategic defense research. I am not aware of any qualitative changes in Soviet posture or activities requiring a responsive crash program. However,the intelligence community and the Defense Department are more qualified to respond to the question.

12P. In your original draft testimony you say: "It is much too early to proceed with deployment of proliferated defensive systems. We do not have in place the strategic policy or arms control frame work with which to deal with defenses. We do not have answers to all the technical questions." In other words, are you saying this push toward a near term deployment is much too premature at this point? Are you saying we have a lot more research and thinking to do before we should begin considering any type of deployment?

As I said in my testimony, it is too early to proceed with deployment of proliferated defensive systems. It is very important to engage in intense study and discussion of the actual deployment of defensive systems in order to understand better the full range of technical and policy issues which must be addressed before deployment can proceed. To maximize the confidence in a deployment decision, we must have as much technical information as possible about feasible evolutionary paths for both offensive and defensive systems. I support the continuation of a well-funded, balanced SDI research program to examine both near and far term technologies to support the President's goal.

SUBCOMMITTEE RECESS

Chairman STENNIS. All right, we will take a recess now subject to the call of the Chair. Thank you for coming and staying.

[Whereupon, at 1:03 p.m., Thursday, March 26, the hearing was recessed, to reconvene at the call of the Chair.]

DEPARTMENT OF DEFENSE APPROPRIATIONS FOR FISCAL YEAR 1988

THURSDAY, APRIL 2, 1987

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 2:40 p.m. in room SD–192, Dirksen Senate Office Building, Hon. John Stennis (chairman) presiding.

Present: Senators Stennis, Proxmire, Johnston, Hollings, Stevens, McClure, and Cochran.

NONDEPARTMENTAL WITNESSES

SPECIAL ADVISOR TO THE PRESIDENT AND SECRETARY OF STATE ON ARMS CONTROL MATTERS

STATEMENT OF THE HONORABLE PAUL H. NITZE

STRATEGIC DEFENSE INITIATIVE

HEARING PROCEDURE

Chairman STENNIS. Our meeting will please come to order, ladies and gentlemen. We greatly regret the fact that we were not here on time as scheduled. We were detained on other important Senate business.

Also, I regret to take the time from our valuable and highly respected witness. You have a special welcome here, Ambassador Nitze, and I have heard your testimony from time to time for many years on this and other related committees. You are considered a very valuable witness and certainly have a splendid record.

I am not here to just cast flowers on anyone, but your background is always relevant in these highly important matters requiring much thought and various approaches. With your experience, your achievements and accomplishments, you come here today and wait, and you have other matters pressing you.

And I am told that you will be compelled to go at 4 o'clock, which everyone will regret, but we certainly will respect it.

I have a statement here that I am going to give, except that I may abbreviate it some to save time. And I ask unanimous consent now that the whole statement be inserted in the record and become a part of the official record.

[The material follows:]

PREPARED STATEMENT OF HON. JOHN C. STENNIS

U.S. SENATOR FROM MISSISSIPPI

Good afternoon. Today, the Subcommittee holds its third hearing into the issues surrounding the Defense Department's budget request for the Strategic Defense Initiative for fiscal 1988 and 1989. We will focus on the relationship between SDI and efforts to control both offensive and defensive nuclear arms.

With us to discuss this highly important subject is Ambassador Paul H. Nitze, Special Advisor to the President and the Secretary of State on Arms Control Matters. He is accompanied by Ambassador Henry F. Cooper, the Deputy U.S. Negotiator for Defense and Space Arms at the United States-Soviet talks in Geneva, Switzerland.

We look forward to hearing Ambassador Nitze's statement, and both these experienced arms control negotiators will be available to answer questions by any member of the Subcommittee.

Since its very inception, one of the most controversial aspects of the SDI program has been its impact on arms control efforts, both in the offensive and defensive arenas. The linkage of any agreement to reduce offensive strategic nuclear forces to limits on SDI, and the debate about the reinterpretation of the Anti-Ballistic Missile Treaty, epitomize this impact.

Issues about the pace, scope, direction, and funding levels of SDI have merged with the debate about whether the program is an incentive, or obstacle, to preserving existing arms control arrangements and to reaching new agreements.

Several members of this subcommittee feel we should keep program and budget issues separate from the arms control considerations, but these subjects seem inextricably linked in both Administration positions and the minds of our colleagues and the public.

Ambassador Nitze, you are on the front lines where SDI and arms control meet, either to undercut or reinforce each other as we deal with the Soviets. The Senate needs your insights to help assess the program's impact on these complicated negotiations—on how the debate about the size of the annual SDI budget, and about the "traditional" and "broad" interpretations of the ABM Treaty affect Soviet behavior and prospects for reducing strategic arms.

Many on both sides of the issue contend that SDI and arms control are incompatible.We would like to hear if you think it is possible to craft arms control agreements which protect the essential elements of SDI research without jeopardizing the fundamental aspects of the ABM Treaty.

SDI's role as either a "bargaining chip" or "negotiating leverage" is an issue, and many Senators wish to know if the Administration is willing to consider any restrictions on the program—as long as it stays alive—in exchange for deep reductions in Soviet strategic offensive forces.

Allied support for U.S. arms control positions is important to convince the Soviets to bargain in good faith. You are our "point man" to explain these policies to our NATO allies, and we are interested in the current level of support among our allies for the SDI program, in general, and for early deployment and the broader interpretation of the ABM Treaty, in particular.

Finally, as a former negotiator of the ABM Treaty, your views about the reinterpretation are valuable to us.

After any comments by our Ranking Minority Member, Senator Stevens, we will begin.

IMPACT OF SDI PROGRAM ON ARMS CONTROL

Chairman STENNIS. Since its very inception, one of the most controversial aspects of the SDI program has been its impact on arms control efforts, both in the offensive and defensive areas. The linkage of any agreement to reduce offensive strategic nuclear forces to limits on SDI and the debate about the reinterpretation of the Anti-Ballistic Missile Treaty epitomize this impact.

Issues about the pace, scope, direction, and funding levels of the SDI have merged with the debate about if the program is an incentive or obstacle to preserving existing arms control arrangements and to reaching new agreements. Several members of this subcommittee feel we should keep program and budget issues separate from the arms control considerations.

But these are subjects that seem inextricably linked in both administration positions and the minds of our colleagues and the public.

Ambassador Nitze, you are on the front lines when SDI and arms control meet, either to undercut or to reinforce each other as we deal with the Soviets.

SDI's role as either a bargaining chip or negotiating leverage is an issue, and many Senators wish to know if the administration is willing to consider any restrictions on the program, as long as it stays alive, in exchange for deep reductions in Soviet strategic offensive forces. Allied support for United States arms control positions is important to convince the Soviets to bargain in good faith.

You are our point man to explain these policies to our NATO allies, and we are interested in the current level of support among our allies for the SDI program in general and for early deployment and the broader interpretation of the ABM Treaty in particular.

Finally, as a former negotiator of the ABM Treaty, your views about the reinterpretation are valuable to us.

After any comments by the ranking minority member, Senator Stevens, we will begin. Senator Stevens of Alaska.

IMPACT OF DISPUTE ON SDI

Senator STEVENS. Mr. Chairman, I am delighted that my good friend Ambassador Nitze is here today. And he has a very important statement, I think, as one of those who participated in the negotiation of the ABM Treaty. It would be my hope that Ambassador Nitze will present it in full, because I think that it is a comprehensive statement that totally deals with the dispute that is raging.

I will have some comments to make about that dispute later. But the real question that we have now is, what is the impact of this dispute on SDI? And I welcome the Ambassador's statement from that point of view.

Chairman STENNIS. All right. Thank you, sir. And we hope that other members who have been tied up irrevocably on the floor can make their way to this hearing.

All right, Mr. Nitze, you may proceed.

INTERPRETATION OF ABM TREATY

Ambassador NITZE. Mr. Chairman, Ambassador Kampelman was previously scheduled to appear before your committee in this timeframe. Unfortunately, he cannot be here. We talked to Max today. He is doing fine and sends his warmest regards to you, Mr. Chairman, and to the other members of your committee individually and collectively.

Now, let me proceed to my statement with respect to what I believe to be the correct interpretation of the ABM Treaty. Mr. Chairman, I am pleased to appear today before this subcommittee to discuss the ABM Treaty and my views as to the limits that treaty places on strategic defense development and testing activities.

As you know, an administration analysis of the ABM Treaty negotiating record has been completed and made available to the Senate. On the basis of that analysis, President Reagan concluded that the so-called broad interpretation of the treaty's provisions was fully justified. We continue to support that conclusion.

Six weeks ago, President Reagan directed that comprehensive analyses also be conducted of the other two bodies of evidence that may bear on the proper business of the treaty, the record of subsequent practice of the two parties and the U.S. treaty ratification proceedings. These studies should be completed by April 30.

The administration will consult fully with the Congress on the results of these studies and the implications of all three analyses for the future conduct of the SDI program.

PARAMETERS OF TREATY ISSUES

As the debate on ABM Treaty interpretation continues, it is important to make clear the parameters of the issue. In my prepared remarks, I will try to do so and to clarify as well why my recollection of the ABM Treaty negotiations, reinforced by my review of the negotiating record, leads me to believe that the limits posited by the broad interpretation are all that the Soviet negotiators agreed to in a manner binding on themselves.

TREATY DISPUTE

Next, let me deal with the nature of the dispute. Most of the ABM Treaty as it bears upon the SDI program is not in dispute. The issue between the broad and the narrow interpretation relates to the fact that at the time the treaty was negotiated all ABM systems then deployed or contemplated for deployment were based upon a combination of ABM interceptor missiles, launchers for those missiles, and ABM radars.

The broad versus narrow issue concerns only the development and testing of systems based upon physical principles other than those involved in such ABM interceptor missiles, launchers, and radars, and of the components of such systems.

The current debate poses no issue with respect to the deployment either of components or of systems based upon other physical principles. All are agreed that deployment of such components or systems is not permitted without prior consultation and amendment to the treaty. Thus the basic principle of the treaty, that without amendment to the treaty neither side may deploy systems or components except as provided in article III, is not in question.

RESEARCH PROGRAMS

There is also no issue with respect to research. The word "research" is nowhere used in the treaty. With respect to testing, the issue does not apply to the testing of components of fixed ground-based ABM systems at an agreed test site or deployment area, regardless of whether an interception occurs in space or in the atmosphere. Article IV permits such testing.

The issue also does not apply to testing of systems based on other physical principles that are fixed and land based.

The issue concerns only tests of mobile, including space-based, systems based upon other physical principles and their components able to substitute for: one, ABM interceptor missiles; two, ABM launchers; or three, ABM radars.

Under the narrow interpretation, such tests would not be permitted because that interpretation would require the substitute component to be fixed, land based, and at an agreed test range or deployment area. Under the broader interpretation, they would generally be permitted even if mobile, including space based.

TREATY PROVISIONS

Now, let me go to the provisions of the treaty, Mr. Chairman. To aid in understanding the interpretation issue, it is useful to have in mind the pertinent provisions of the treaty. The following is a condensation of those provisions. The full text is, of course, available to those who prefer to consult it.

Article I of the treaty prohibits deployment of ABM systems for territorial defense and providing a base for such a defense. It also prohibits deployment of ABM systems for defense of an individual region, except as provided in article III. Article I thus limits deployment, not testing, and limits ABM systems, not ABM components.

Article II defines an ABM system as "a system to counter strategic ballistic missiles or their elements in flight trajectory, currently consisting of:" ABM interceptor missiles, which are missiles constructed and deployed for an ABM role or of a type tested in an ABM mode; ABM launchers, which launch ABM interceptor missiles; and ABM radars, which are radars constructed and deployed for an ABM role or of a type tested in an ABM mode.

These are the components essential to all ABM systems being deployed or developed in 1972.

Article III states that no ABM systems or components may be deployed other than those ABM missiles, launchers, and radars it specifically allows. The article then specifies the areas in which ABM systems or their components may be deployed and the number that may be deployed in those areas.

Article IV exempts from the limitations of Article III ABM systems or their components used for development or testing and located within agreed test ranges.

Article V prohibits the development, testing, and deployment of sea-based, air-based, space-based, and mobile land-based ABM systems and ABM components.

Article VI, paragraph A, prohibits giving non-ABM missiles, launchers, or radars an ABM capability or testing them in an ABM mode.

Agreed Statement D, to preclude any ABM system deployment except as explicitly permitted by Article III, provides that, if ABM systems based on physical principles other than those used for ABM components in 1972, including components capable of substituting for ABM interceptor missiles, ABM launchers, or ABM radars, are created in the future, specific limitations on those systems and components would be subject to discussion in accordance with Articles XIII and agreement in accordance with Article XIV.

INTERPRETATION DISPUTE

The interpretation dispute centers on the question of which of these provisions apply to mobile systems based on other physical principles, including mobile components capable of substituting for ABM components. The narrow interpretation maintains that Article V applies to all mobile ABM systems and components, even if they are not components as defined in Article II and regardless of the physical principle involved.

Mobile systems based on other physical principles and their components capable of substituting for conventional ABM components thus would be captured by the Article V ban on testing and development.

The broad interpretation is that Agreed Statement D is the only part of the treaty dealing with systems based on other physical principles and their components, and that Agreed Statement D allows both parties to create, i.e., to develop and test to the point of creation, such systems and components, but not to deploy them.

I remain convinced that, though the U.S. negotiators, including me, attempted to achieve a ban on the developing and testing of space-based and other mobile devices capable of substituting for ABM components, we failed to do so with the degree of certainty that is necessary for important international agreements.

All we achieved in the form the Soviets would consider binding on themselves was a ban on deployment, not on the creation of such systems and components.

NEGOTIATING RECORD

Now let me deal with the negotiating record. The negotiating record of the ABM treaty is classified, like that of other treaties. Therefore, I cannot cite it specifically in these remarks. Instead, I will describe my own recollection of the course of the treaty negotiations, in which I was intimately involved, as refreshed by my recent review of the record.

The U.S. unquestionably sought to regulate comprehensively not only—comprehensively and decisively not only the three components defined in Article II—that is, ABM interceptor missiles, ABM launchers, and ABM radars—but all devices that could substitute for those components.

In the provision that ultimately became Article V, we sought to prohibit the development, testing, and deployment of space-based or other mobile ABM missiles, ABM launchers, ABM radars, and other devices to perform the functions of these components.

The draft treaty also contained an absolute ban on development, testing, or deployment in space, but the Soviets explicitly limited its application to missiles, launchers, and radars, and they repeatedly opposed having the treaty cover devices other than those components. They pointed out that it was impossible to know what the components of a system based on a technology not then employed would look like, how they could be defined, and how they should be regulated.

SOVIET PROPOSED CHANGE IN ARTICLE V

After considerable back and forth on this issue, the Soviets proposed a change in Article V and assured the U.S. negotiators that the new language would apply to any type of future component. We agreed to this change.

The Soviet assurance appeared to achieve part of the U.S. objective, in that it included coverage of future ABM missiles, launchers, or radars. But the change we accepted in this provision resulted in the deletion, at Soviet insistence, of the U.S. language expressly covering substitute devices for such components.

At the same time, the Soviets had on the table a draft of Article II that defined an ABM system as one that consisted of the three conventional components, i.e., ABM interceptor missiles, ABM launchers, and ABM radars. Furthermore, the Soviets continued to argue, with respect to the U.S. effort to regulate substitute "devices," that they opposed in principle attempts to regulate the unknown.

Although this argument was repeatedly made and remained a central issue in the negotiations, we U.S. negotiators did not seek to confirm that the Soviets had in fact agreed to regulate unknown devices in Article V. Had we done so, it would have been entirely consistent with the Soviet position for them to have reminded us that the language concerning "devices" had been deleted from Article V and to have stated that they had agreed to regulate only future "components," which they had defined in their article, in their draft of Article II, to consist of ABM missiles, launchers, and radars.

Indeed, given the subsequent events, any other outcome seems implausible.

COMPROMISE ON ARTICLE II

As the negotiations continued, the Soviets accepted a U.S.-proposed compromise on Article II that added the phrase "currently consisting of" in front of the list of ABM components. It has been argued that this revision of Article II could be considered to have expanded the Soviet commitment in Article V to encompass substitute devices.

This claim is contradicted, however, by the fact that the Soviets accepted the revision only after we explicitly assured them that the coverage of substitute devices would be settled elsewhere than in Article II.

After Article II was negotiated, the Soviets still continued to oppose attempts to regulate substitute devices. They suggested that if systems or components based on other physical principles were created in the future, we should discuss the matter in the Standing Consultative Commission to be created under Article XIII.

We asked them, what would happen if it were impossible to achieve agreement? They suggested the other side could then withdraw from the treaty. I, among others, said I believed that would be too extreme a remedy.

AGREED STATEMENT D

This led to Agreed Statement D, in which the Soviets agreed in effect that, after such devices were "created," their deployment would be permitted, if at all, only after discussions and agreement.

Some proponents of the narrow interpretation recall that a Soviet negotiator made an oral statement in January 1972 to the effect that Agreed Statement D specifically permitted the sides to develop and test, but not to deploy, stationary futuristic systems.

Assuming such an oral statement was made, it would confirm that Agreed Statement D does indeed contemplate the "creation" of components based on other physical principles and that "creation" was recognized to include development and testing.

But would such an unrecorded oral statement be considered by the Soviets to be binding on them to the extent of barring them from creating non-stationary components, a point the statement did not address?

The Soviets did agree at one point to one aspect of the American position concerning future substitute components, but their agreement followed the reading by the U.S. side of a carefully prepared position paper that proposed only that the parties agree to ban the deployment, not the development or testing, of such future substitute systems or components.

Futhermore, nowhere did the paper mention a distinction between fixed land-based substitutes and substitutes based in space or elsewhere, nor does Agreed Statement D reflect such a distinction.

In the absence of a definition of what would distinguish a "component" of a system based upon other physical principles from an "element" or a non-component of such a system, a limitation on development or testing of components would be difficult, if not impossible, to apply in a rigorous, consistent, and verifiable manner.

This is a problem we are beginning to face today. Soviet scientists tell us they are planning a space probe which will have on board both a laser of some power and a particle beam device. They propose to test these devices against one of the moons of Mars, called Phoebus. They say the purpose of the test is to knock pieces off the moon's surface and thereby determine the characteristics of that surface.

It would be difficult to prove that the power, brightness, and tracking and aiming characteristics of these devices are such as to demonstrate that the devices had the capability to substitute for ABM components.

A similar problem arises with mirrors capable of reflecting and focusing lasers or other directed energy beams. Under what conditions would such a mirror satisfy the definition of being "capable of substituting for" an ABM interceptor, ABM launcher, or ABM radar?

The treaty language is of little help in answering such questions. Agreed Statement D does not define components capable of substituting for ABM interceptor missiles, launchers, or radars. It states only that, if such components or systems based on them are created in the future, they be subject to discussion in the Standing Consultative Commission and be deployed only after appropriate amendments to the treaty.

In the case of non-ABM missiles, launchers, and radars, Article VI.A provides that they not be given capabilities to counter strategic ballistic missiles or their elements in flight trajectory, and that they not be tested in an ABM mode.

In sum, my recollection of the negotiating process leaves me convinced that the Soviets agreed in a binding manner to prohibit only the deployment, not the creation, i.e., the development and testing, of systems based on other physical principles and their components capable of substituting for the conventional components as defined in Article II, regardless of basing mode.

SOVIET INTERPRETATION OF TREATY

Now let me say a word about the Soviet interpretation of the treaty. While arguing against the broad interpretation of the ABM treaty, Soviet officials also place great emphasis on Article I of the treaty and what they claim are the Article's implications for SDI.

The Soviets note that Article I prohibits deploying ABM systems to defend a country's territory and providing a base for such a defense. They claim that SDI, particularly as it relates to space-based ABM systems, is providing a base for a national territorial defense, and that therefore SDI violates Article I.

This argument is contradicted by views previously expressed by the Soviet side in a major statement before the Soviet Presidium in 1972, shortly after the ABM treaty was signed. Then-Soviet Defense Minister Grechko stated that the treaty "places no limitations on the performance of research and experimental work aimed at resolving the problem of defending the country from nuclear missiles."

Grechko's view thus explicitly contemplates that the sides are free to conduct a strategic defense program like that being done by SDI and by the similar Soviet program. Grechko's statement is not, however, an unambiguous rejection of the narrow interpretation.

My conclusion that the Soviets were unwilling to agree to the narrow interpretation is based on our lack of success in securing Soviet acceptance during the negotiations of language which would have made that interpretation clear.

Mr. Chairman, in concluding my prepared remarks, let me emphasize the administration's intent to cooperate with the Congress in resolving this matter. As I stated earlier, after our analyses of the record of subsequent practices and of the ratification proceedings are completed, we will share them with the Congress, as we have our analysis of the negotiating record.

We will then begin a series of consultations designed to reach a fuller understanding of the treaty interpretation question and to establish guidelines for SDI development and testing activities that will continue to merit Congressional, allied, and public support.

Thank you, Mr. Chairman.

[The prepared statement of Ambassador Nitze follows:]

PREPARED STATEMENT OF PAUL H. NITZE

SPECIAL ADVISOR TO THE PRESIDENT AND SECRETARY OF STATE ON ARMS CONTROL MATTERS

Mr. Chairman:

I am pleased to appear today before this subcommittee to discuss the ABM Treaty and my views as to the limits that Treaty places on strategic defense development and testing activities.

As you know, an Administration analysis of the ABM Treaty negotiating record has been completed and made available to the Senate. On the basis of that analysis, President Reagan concluded that the so-called broad interpretation of the Treaty's provisions was fully justified. We continue to support that conclusion.

Six weeks ago, President Reagan directed that comprehensive analyses also be conducted of the other two bodies of evidence that may bear on the proper interpretation of the Treaty -- the record of subsequent practice of the two parties and the US Treaty ratification proceedings. These studies should be completed by April 30. The Administration will consult fully with the Congress on the results of the studies and the implications of all three analyses for the future conduct of the SDI program.

As the debate on ABM Treaty interpretation continues, it is important to make clear the parameters of the issue. In my prepared remarks, I will try to do so, and to clarify as well why my recollection of the ABM Treaty negotiations, reinforced by my review of the negotiating record, leads me to believe that the limits posited by the broad interpretation are all that the Soviet negotiators agreed to in a manner binding on themselves.

Nature of the Dispute

Most of the ABM Treaty, as it bears upon the SDI program, is not in dispute. The issue between the broad and the narrow interpretation relates to the fact that, at the time the Treaty was negotiated, all ABM systems then deployed or contemplated for deployment were based upon a combination of ABM interceptor missiles, launchers for those missiles, and ABM radars.

The broad versus narrow issue concerns only the development and testing of systems based upon physical principles other than those involved in such ABM interceptor missiles, launchers, and radars, and of the components of such systems.

The current debate poses no issue with respect to the deployment either of components, or of systems, based upon other physical principles; all are agreed that deployment of such components or systems is not permitted without prior consultation and amendment to the Treaty. Thus, the basic principle of the Treaty -- that, without amendment to the Treaty, neither side may deploy systems or components except as provided in Article III -- is not in question.

There is also no issue with respect to research; the word "research" is nowhere used in the Treaty.

With respect to testing, the issue does not apply to the testing of components of fixed, ground-based ABM systems at an agreed test site or deployment area, regardless of whether an interception occurs in space or in the atmosphere. Article IV permits such testing. The issue also does not apply to testing of systems based on other physical principles that are fixed and land-based.

The issue concerns only tests of mobile (including space-based) systems based upon other physical principles and their components able to substitute for: (1) ABM interceptor missiles, (2) ABM launchers, or (3) ABM radars.

Under the narrow interpretation such tests would not be permitted because that interpretation would require the substitute component to be fixed, land-based and at an agreed test range or deployment area. Under the broader interpretation they would generally be permitted, even if mobile (including space-based).

Provisions of the Treaty

To aid in understanding the interpretation issue, it is useful to have in mind the pertinent provisions of the Treaty. The following is a condensation of those provisions; the full text is, of course, available to those who prefer to consult it.

Article I of the Treaty prohibits deployment of ABM systems for a territorial defense and providing a base for such a defense. It also prohibits deployment of ABM systems for defense of an individual region except as provided in Article III. Article I thus limits deployment, not testing, and limits ABM systems, not ABM components.

Article II defines an ABM system as "a system to counter strategic ballistic missiles or their elements in flight trajectory, currently consisting of:" ABM interceptor missiles, which are missiles constructed and deployed for an

ABM role or of a type tested in an ABM mode; ABM launchers, which launch ABM interceptor missiles; and ABM radars, which are radars constructed and deployed for an ABM role or of a type tested in an ABM mode. These are the components essential to all ABM systems being deployed or developed in 1972.

Article III states that no ABM systems or components may be deployed other than those ABM missiles, launchers, and radars it specifically allows. The Article then specifies the areas in which ABM systems or their components may be deployed, and the number that may be deployed in those areas.

Article IV exempts from the limitations of Article III ABM systems or their components used for development or testing and located within agreed test ranges.

Article V prohibits the development, testing and deployment of sea-based, air-based, space-based, and mobile land-based ABM systems and ABM components.

Article VI, paragraph (a), prohibits giving non-ABM missiles, launchers, or radars an ABM capability or testing them in an ABM mode.

Agreed Statement D, to preclude any ABM system deployment except as explicitly permitted by Article III, provides that, if ABM systems based on physical principles other than those used for ABM components in 1972, including components capable of substituting for ABM interceptor missiles, ABM launchers or ABM radars, are created in the future, specific limitations on those systems and components would be subject to discussion in accordance with Article XIII and agreement in accordance with Article XIV.

The interpretation dispute centers on the question of which of these provisions apply to mobile systems based on other physical principles, including mobile components capable of substituting for ABM components. The narrow interpretation maintains that Article V applies to all mobile ABM systems and components, even if they are not components as defined in Article II and regardless of the physical principle involved. Mobile systems based on other physical principles and their components capable of substituting for conventional ABM components would thus be captured by the Article V ban on testing and development.

The broad interpretation is that Agreed Statement D is the only part of the Treaty dealing with systems based on other physical principles and their components, and that Agreed Statement D allows both parties to create, i.e., to develop and test to the point of "creation", such systems and components but not to deploy them.

I remain convinced that, though the US negotiators, including me, attempted to achieve a ban on the development and testing of space-based and other mobile devices capable of substituting for ABM components, we failed to do so with the degree of certainty that is necessary for important international agreements. All we achieved, in a form the Soviets would consider binding on themselves, was a ban on deployment, not on the creation of such systems and components.

The Negotiating Record

The negotiating record of the ABM Treaty is classified, like that of other treaties. Therefore, I cannot cite it specifically in these remarks. Instead, I will describe my own recollection of the course of the Treaty negotiations, in which

I was intimately involved, as refreshed by my recent review of the record.

The US unquestionably sought to regulate comprehensively not only the three components defined in Article II -- that is, ABM interceptor missiles, ABM launchers, and ABM radars -- but all devices that could substitute for those components. In the provision that ultimately became Article V, we sought to prohibit the development, testing, and deployment of space-based or other mobile (1) ABM missiles, (2) ABM launchers, (3) ABM radars, and (4) other devices to perform the functions of these components.

The Soviet draft treaty also contained an absolute ban on development, testing, or deployment in space, but the Soviets explicitly limited its application to missiles, launchers, and radars, and they repeatedly opposed having the Treaty cover devices other than those components. They pointed out that it was impossible to know what the components of a system based on a technology not then employed would look like, how they could be defined, and how they should be regulated.

After considerable back-and-forth on this issue, the Soviets proposed a change in Article V and assured the US negotiators that the new language would apply to any type of future component. We agreed to this change.

The Soviet assurance appeared to achieve part of the US objective, in that it included coverage of future ABM missiles, launchers, or radars. But the change we accepted in this provision resulted in the deletion, at Soviet insistence, of the US language expressly covering substitute devices for such components.

At the same time, the Soviets had on the table a draft of Article II that defined an ABM system as one that consisted of the three conventional components, i.e. ABM interceptor missiles, ABM launchers, and ABM radars. Furthermore, the Soviets continued to argue, with respect to the US effort to regulate substitute "devices," that they opposed in principle attempts to regulate the unknown.

Although this argument was repeatedly made, and remained a central issue in the negotiations, we US negotiators did not seek to confirm that the Soviets had in fact agreed to regulate unknown devices in Article V. Had we done so, it would have been entirely consistent with the Soviet position for them to have reminded us that the language concerning "devices" had been deleted from Article V, and to have stated that they had agreed to regulate only future "components", which they had defined in their draft of Article II to consist of ABM missiles, launchers, and radars. Indeed, given the subsequent events, any other outcome seems implausible.

As the negotiations continued, the Soviets accepted a US-proposed compromise on Article II that added the phrase "currently consisting of" in front of the list of ABM components. It has been argued that this revision of Article II could be considered to have expanded the Soviet commitment in Article V to encompass substitute devices. This claim is contradicted, however, by the fact that the Soviets accepted the revision only after we explicitly assured them that the coverage of substitute devices would be settled elsewhere than in Article II.

After Article II was negotiated, the Soviets still continued to oppose attempts to regulate substitute devices.

They suggested that if systems or components based on other physical principles were created in the future we should discuss the matter in the Standing Consultative Commission to be created under Article XIII. We asked them what would happen if it were impossible to achieve agreement. They suggested either side could then withdraw from the Treaty. I, among others, said I believed that would be too extreme a remedy. This led to Agreed Statement D, in which the Soviets agreed, in effect, that, after such devices were "created", their deployment would be permitted, if at all, only after discussions and agreement.

Some proponents of the narrow interpretation recall that a Soviet negotiator made an oral statement in January 1972 to the effect that Agreed Statement D specifically permitted the sides to develop and test -- but not to deploy -- stationary futuristic systems. Assuming such an oral statement was made, it would confirm that Agreed Statement D does indeed contemplate the "creation" of components based on other physical principles and that "creation" was recognized to include development and testing. But would such an unrecorded oral statement be considered by the Soviets to be binding on them to the extent of barring them from creating non-stationary components, a point the statement did not address?

The Soviets did agree at one point to one aspect of the American position concerning future, substitute components. But their agreement followed the reading by the US side of a carefully prepared position paper that proposed only that the parties agree to ban the deployment, not the development or testing, of such future substitute systems or components. Furthermore, nowhere did the paper mention a distinction between fixed, land-based substitutes and substitutes based in space or elsewhere. Nor does Agreed Statement D reflect such a distinction.

In the absence of a definition of what would distinguish a "component" of a system based upon other physical principles from an "element", or non-component, of such a system, a limitation on development or testing of components would be difficult, if not impossible, to apply in a rigorous, consistent, and verifiable manner. This is a problem we are beginning to face today.

Soviet scientists tell us they are planning a space probe which will have on board both a laser of some power and a particle beam device. They propose to test these devices against one of the moons of Mars, called Phoebus. They say the purpose of the test is to knock pieces off the moon's surface and thereby determine the characteristics of that surface.

It would be difficult to prove that the power, brightness, and tracking and aiming characteristics of these devices are such as to demonstrate that the devices have the capability to substitute for ABM components. A similar problem arises with mirrors capable of reflecting and focusing laser or other directed energy beams. Under what conditions would such a mirror satisfy the definition of being "capable of substituting for" an ABM interceptor, ABM launcher or ABM radar?

The Treaty language is of little help in answering such questions. Agreed Statement D does not define components capable of substituting for ABM interceptor missiles, launchers, or radars. It states only that, if such components, or systems based on them, are created in the future, they be subject to discussion in the Standing Consultative Commission and be deployed only after appropriate amendment to the Treaty.

In the case of non-ABM missiles, launchers, and radars, Article VI(a) provides that they not be given capabilities to counter strategic ballistic missiles or their elements in flight trajectory, and that they not be tested in an ABM mode.

In sum, my recollection of the negotiating process leaves me convinced that the Soviets agreed in a binding manner to prohibit only the deployment, not the creation (i.e. the development and testing), of systems based on other physical principles and their components capable of substituting for conventional components as defined in Article II, regardless of basing mode.

Soviet Interpretation of the Treaty

While arguing against the broad interpretation of the ABM Treaty, Soviet officials also place great emphasis on Article I of the Treaty and what they claim are that Article's implications for SDI. The Soviets note that Article I prohibits both deploying ABM systems to defend a country's territory and providing a base for such a defense. They claim that SDI, particularly as it relates to space-based ABM systems, is providing a base for a national territorial defense and that, therefore, SDI violates Article I.

This argument is contradicted by views previously expressed by the Soviet side. In a major statement before the Soviet Presidium in 1972, shortly after the ABM Treaty was signed, then-Soviet Defense Minister Grechko stated that the Treaty "places no limitations on the performance of research and experimental work aimed at resolving the problem of defending the country from nuclear missile strike." Grechko's view thus explicitly contemplates that the sides are free to conduct a strategic defense program like that being done by SDI and by the similar Soviet program.

Grechko's statement is not, however, an unambiguous rejection of the narrow interpretation. My conclusion that the Soviets were unwilling to agree to the narrow interpretation is based on our lack of success in securing Soviet acceptance during the negotiations of language which would have made that interpretation clear.

Conclusion

Mr. Chairman, in concluding my prepared remarks, let me emphasize the Administration's intent to cooperate with the Congress in resolving this matter. As I stated earlier, after our analyses of the record of subsequent practice and of the ratification proceedings are completed, we will share them with the Congress, as we have our analysis of the negotiating record. We will then begin a series of consultations designed to reach a fuller understanding of the treaty interpretation question, and to establish guidelines for SDI development and testing activities that will continue to merit Congressional, Allied and public support.

(0835a)

Chairman STENNIS. Thank you, Ambassador Nitze.

I want to divide the time that we have among the members who found it possible to be here. All wanted to come.

By the way, I understand you have to depart from here at 4:30, is that correct?

Ambassador NITZE. Well, my plane leaves at 5:00 and I would like to pick up my bag, so 4:30 makes it a little close. I would like to leave around 4:15 or 4:20, if possible.

Chairman STENNIS. That will be fine. I am going to give others an opportunity to ask questions in a minute. But let me just say that I am encouraged to see so many intelligent visitors here this afternoon. That shows a concern and an interest.

You are taxpayers, too. I know you would be interested to know that the requests to this committee and the other committees that pass on it for this weaponry the next 12 months that will start soon comes to, in round numbers, $5 billion.

That is just for a 12-month period. That begins to describe the importance of this matter. And there will be many times $5 billion if the entire system is used.

Now, I have just a few questions, then I will defer to others. And we will have the 8-minute rule apply.

EFFECT OF BUDGET REDUCTIONS ON SDI PROGRAM

Each year while Congress has provided sufficient funding for a robust SDI—the research program in outer space weaponry, I call it—it also has made significant reductions below the annual SDI budget request.

Now, do you have any evidence that these annual reductions have hindered our arms control negotiators and encouraged the Soviets to make unreasonable demands about SDI? Could you shed any light on that? It would be highly valuable.

Ambassador NITZE. It is very hard to be clear as to all the various factors that impinge upon Soviet decisionmaking. It is, I think, without doubt that where we have been particularly hung up in these negotiations is getting agreement from the Soviets with respect to the proper handling of the space defense issues.

That where we have made perhaps the least progress is in that field. And it would not surprise me if the fact that we have made the least progress in that field is because of the fact that it is not certain that the Congress will wish to continue to support the SDI program at the full level necessary really even to do the research in the best way possible.

I cannot be sure that that is right, but it would not surprise me if that is right.

OPPOSITION TO ABM TREATY BY NATO ALLIES

Chairman STENNIS. All right, sir. One other question here. It has been reported that our major NATO allies oppose the broader interpretation of the ABM treaty. Now, what is the position of the British, the West Germans, the French, and the Italian governments as far as you know on this important issue?

And what is the impact of those positions on Soviet behavior in the negotiations? Your opinion is worth something on that, and that is what we want, your opinion.

Ambassador NITZE. I did go over to Europe, I think it was six weeks ago, and talked to many of the important members of the European governments involved, including Mrs. Thatcher and the foreign minister and defense minister in England and several people of high stature in the other important countries involved.

And one got really quite a diverse panoply of views, as one would from any group of democratic countries. And I think it is, however, possible to summarize the general view. I think the general view was that: We Europeans do not have available the negotiating record, and therefore we are not in a good position to judge this issue; we do, however, tend—we do, however, feel that we have a justified interest in the political impact of a decision by the U.S. Government on this score, and particularly we are concerned by the impact of a decision by the United States upon the negotiations with the Soviets because we have a strong positive interest in the success of the arms control negotiations.

We also have an interest because we are concerned about the coherence of the alliance, and this has an important political impact within our various countries, and this could have an impact upon the coherence of the alliance.

Therefore, what we are saying to you is that we have an interest in it, we tend to hope that you will come out with the narrow interpretation, but we do not assert that we have any basis for judging which is the correct one.

Now, there were certain variations, as I say, particularly from Mrs. Thatcher, who was much more positive. Her view was that one ought to prosecute, if at all possible, the SDI program to a point where one could really see whether or not it could really be of great importance to the alliance, by presenting us with the possibility for practical and cost-effective defense, and one ought to continue that research to the point where one really had enough evidence to tell whether or not this could meet the President's criteria.

I think that was shared by some of the others, but I think the first view that I gave you was more or less the consensus view.

Chairman STENNIS. I want to get to the other members of the body here who are interested in your testimony and this vital question.

So I am going to call on Senator Stevens first. Senator Stevens is from Alaska, and he is, you might say, a profound scholar. I know he is experienced in a lot of ways in various endeavors, weaponry included, and has been a valuable man on our committee.

Senator Stevens.

DEFENSE SPACE PORTION OF TREATY

Senator STEVENS. Thank you, Mr. Chairman.

I too have gone over the classified record in detail, Mr. Ambassador. Let me ask you this. In terms of the negotiations in Geneva, the scope of the ABM treaty, in view of the defense space portion of the negotiations there, that scope is on the table, too, is it not?

Ambassador NITZE. I am not quite sure what you mean by "scope"?

Senator STEVENS. The scope of the interpretation of the treaty, broad or narrow.

Ambassador NITZE. The question as to what is the meaning of the treaty is on the table. But the one thing that we are reluctant to do, because we do not think it is right or necessary, is to discuss with the Soviets amendments to the ABM treaty.

Senator STEVENS. Yes, I understand that. The amendments are not on the table. I assume that they could ask to be there and that might become an issue later on, but right now in terms of our approach the question of the interpretation is something that can be discussed with the Soviets?

Ambassador NITZE. It not only can be, but is, discussed. It has been discussed ad nauseam, in fact, at Geneva. It was discussed for at least an hour and a half in my discussions with Akhrameyov at Reykjavik. It was discussed.

Senator STEVENS. So if the Congress were to take it upon itself to attempt to narrow the interpretation or to commit us to the narrow interpretation, it would in effect be taking one of the items off the table, would it not?

Ambassador NITZE. Yes, it would, although as I said their attack against SDI is somewhat broader even than the attack upon the broad interpretation. They are saying the whole thing is illegal.

Senator STEVENS. I hope everyone understands your statement. That is why I was much in hopes you would read it, and I thank you for reading it.

The Soviets belabor Article I more than they belabor Agreed Statement D, do they not?

Ambassador NITZE. That is correct.

Senator STEVENS. But my colleagues belabor our interpretation of Agreed Statement D. They miss the entire attack of the Soviets on our interpretation of the treaty, even beyond Agreed Statement D, is that correct?

Ambassador NITZE. That is correct.

Senator STEVENS. Well, I am hopeful that people will understand that because, having spent as much time as I have spent over there trying to observe and report back to the Senate what our negotiators are doing, and having talked with Ambassador Kampelman and Ambassador Glickman and Ambassador Lehman, I am of the opinion that the worst thing that we could do would be to have the Congress try to force the Administration into changing this broad interpretation, when it is in fact one of the major issues that is involved in the negotiation.

And I do not believe we should see the Soviets achieve by our unilateral action here their position on any one part of the negotiating agenda in Geneva.

I thank you, Mr. Ambassador.

Mr. Chairman, I have some people from home in my office and I appreciate your holding this hearing to hear our good friend.

I might say that no one in a group that has been dealing with the arms control observer group has spent more time with this than Ambassador Nitze. He has been extremely forthcoming in his time, and we are grateful for that.

Thank you very much, Mr. Chairman.

Chairman STENNIS. Thank you for your statement. I am glad you could come and I wish we had more time.

Senator Johnston, that brings us to you, sir.

Senator JOHNSTON. Thank you, Mr. Chairman.

COST EFFECTIVENESS OF SDI

Ambassador Nitze, we are indebted to you for the vigor and logic and discipline of your thought on these matters. I particularly, I agree with the Nitze test: cost effective at the margin.

I also strongly agree with your, I think it was, March 30 piece in the Washington Post, where you said that a deployment decision now or threat to abrogate the ABM treaty would backfire, to the significant detriment of the SDI program. I strongly agree with that.

Now, my question is this. Judge Sofaer, who is, I guess you would call him, the author or at least the principal proponent of the broad interpretation, certainly the one who is given credit for it, in testimony last year before one of the House Foreign Affairs Subcommittees, said this with respect to this question of the meaning of "other physical principles." He said:

"That means defensive systems that serve the same functions as ABM systems and components, but that use devices based on technology not understood in 1972 when the treaty was negotiated and that are capable of substituting for ABM interceptor missiles, launchers, and radars". I repeat, "that use devices based upon technology not understood in 1972."

Ambassador NITZE. This was said by whom?

Senator JOHNSTON. This was Judge Sofaer. I understand you were present at the time.

PHYSICAL PRINCIPLE OF SPACE-BASED KKV

Now, question number one: We do agree, do we not, that the space-based KKV was a well-understood physical principle in 1972?

Ambassador NITZE. I am not in full agreement with this on technology not understood.

Senator JOHNSTON. Well, first of all, before we get to that question, we do agree that space-based KKV was well understood in 1972?

Ambassador NITZE. Space-based KKV was well understood in 1972, that is correct.

Senator JOHNSTON. Okay. Now, do you agree with Judge Sofaer that the phrase "other physical principles" means based upon technology not understood in 1972?

Ambassador NITZE. I have a somewhat different view of that. That means, for instance, components based upon physical principles other than those used in ABM interceptor missiles, ABM launchers, and ABM radars. I think that is the careful reading of Agreed Statement D. That is what it says.

Senator JOHNSTON. You say if it is space-based it is okay?

Ambassador NITZE. I am not talking about that. I am saying Agreed Statement D says the creation of components capable of substituting for ABM interceptor missiles, ABM launchers, and ABM radars based upon other physical principles, is what it says.

Senator JOHNSTON. Right. Now, on July 8, 1977, you wrote a letter to Mr. Donald G. Brennan, a copy of which I have here. If you do not recall it, I will give you a copy. But in that it is stated as follows:

BAMBI-TYPE ABM SYSTEM

"It was our clear intention that Article V bar engineering development of BAMBI type ABM systems. We did not intend, however, that the treaty ban engineering development, testing, or deployment of satellite killers using laser or particle beam devices."

Do you agree—first of all, do you agree that you wrote this, that it was your opinion in 1977 that it was our clear intention that Article V bar engineering development of BAMBI type ABM systems? That is correct, is it not?

Ambassador NITZE. I wrote that letter in 1977. I believed it then to be true. And as you will see, at the end I said I had not consulted any records since that time, or since 1972. So the 5 years—that was memory after 5 years.

Senator JOHNSTON. Well, you agree that BAMBI was a space-based KKV, that it was well understood at the time, and that at least as of 1977 you said it was your "clear intention" that it bar engineering development of BAMBI?

Ambassador NITZE. That is correct.

Senator JOHNSTON. Now, would you tell me, Mr. Nitze, has anything happened since 1977 to change your view of that?

Ambassador NITZE. I still think that is a correct view, if you want my opinion.

Senator JOHNSTON. What you said in 1977?

Ambassador NITZE. What I said in 1977 I still think is a correct view, even though it was based upon no research of the record and after 5 years.

But I would point out that that view was based upon my assumption that BAMBI was going to have a guidance system similar to the guidance system which was in the traditional interceptors.

Senator JOHNSTON. Well, you understand——

Ambassador NITZE. And so that the only question at issue was whether the fact that it was going to kill by impact was different than being killed by an explosion. And I did not think that that was a sufficient difference to say that it was based upon other physical principles.

Senator JOHNSTON. Well, you understand that BAMBI is based upon space-based infrared homing, kinetic kill, involving exactly the same technology as the so-called space-based KKV. As a matter of fact, when you look back at the BAMBI diagrams, they are incredibly similar to the—I do not know whether you have seen General Abrahamson's model mockup.

You know, this latest technology, it looks exactly like this diagram from 1960 in the BAMBI report, and it is based upon precisely the same physical principles. And I think the difference is the interceptor weight is a little different and the homing stage weight is a little different.

But we do agree, then, that the broad or the narrow interpretation of the treaty would prevent testing, deployment of a space-based KKV because it was based upon a well-understood technology as of 1972?

Ambassador NITZE. You refreshed my recollection. I do remember now that BAMBI was based upon infrared guidance. I had forgotten that, but it was.

But that also refreshes my recollection that this issue came up in 1977 in the discussions between the Soviets and ourselves on whether a system such as that would in fact be a system based upon other physical principles or whether it would not.

And it was our position that it would not. It was the Soviet position that it would be. And we finally compromised this issue with the Soviets, in my recollection.

Senator JOHNSTON. This is in 1977?

Ambassador NITZE. In the period 1977, 1978. In that period, I think we compromised it with the Soviets with the language which provided that, in the event such a system was contemplated for test, that that would be taken to the Standing Consultative Commission for consultation. Now, that is my recollection. That may be wrong, but that is my recollection.

Senator JOHNSTON. Well, in what context would a question about a deployment of a BAMBI system, space-based KKV, come up with the Soviet Union in 1977 or 1978?

Ambassador NITZE. Because they understood we were thinking about such a thing, and I'm not sure whether they were or not. But it came up for discussion in 1977.

Senator JOHNSTON. My time is up. Thank you, Mr. Ambassador.

Ambassador NITZE. That is my recollection, Mr. Senator, but it can be checked out.

Chairman STENNIS. Senator Hollings.

Well, I will alternate sides.

Senator MCCLURE. I will pass.

Chairman STENNIS. The Senator from South Carolina.

BAMBI SYSTEM

Senator HOLLINGS. Well, Mr. Ambassador, with respect to the BAMBI system and the use of the language understood, let us get down to the BAMBI system, number one. It was all on paper at best back in 1963, and it never was, as you have talked about, created. It never was tested, it never was developed. It was only theory.

Ambassador NITZE. That is my recollection, yes.

Senator HOLLINGS. That is right. And it did have a different guidance system.

It is interesting to me that the SDI opponents jump from the treaty and try to get support out of the negotiation record. They cannot get it out of the negotiation records. They then jump to the ratification record. And they cannot get it out of there and now they jump to the BAMBI.

And I can tell you that I was here in 1972 when the treaty was ratified. In fact, I met you for the first time in 1972 in the tent in Helsinki as one of the chief negotiators. And nobody ever talked about such a system.

So, Mr. Ambassador, let me put you in a different role. Namely, rather than Judge Sofaer, I would consider you to be the principal proponent of the broad, correct interpretation due to your broad experience and due to your magnificent service given Presidents of both parties over the past 30 to 40 years.

And I know you have been in this particular discipline for 20 years because I have been in the Senate for that length of time. And if there is anybody, who can describe the treaty it is not Judge Sofaer, it is not Senator Hollings, as much as we have been in it; it would be Ambassador Nitze.

And as you say, you met and discussed back and forth with the Soviets, all aspects leading to the ABM Treaty. And I think it is significant that, having reviewed the record, that you have now testified in categorical terms that there is no question that the delegation back in 1971 when we were negotiating tried time and time again to head off, prevent the possibility of exotic systems in space by including them in Article II, and the Soviets time and time again refused.

Is that not correct?

Ambassador NITZE. It was primarily in what was then draft Article VI that we tried to get a specific, unambiguous ban upon the testing of devices capable of substituting for.

Senator HOLLINGS. Yes, sir. The other devices were sought by our negotiators to be in what is Article II, they kept submitting language that would ban them and the Soviets kept refusing. Is that not correct?

Ambassador NITZE. I think that is quite correct. They would never agree to language which explicitly covered devices capable of substituting for the known components.

Senator HOLLINGS. And thereafter we, of course, then compromised and got the best we could, solely on the one single point of deployment of systems that would be created in the future and based on other physical principles, and that was Agreed Statement D.

And my questions, Mr. Chairman, would just go down the list as if we were trying a case as the distinguished colleague from Louisiana appears to try it before a jury. I would just go down each one of the statements and try to re-emphasize it, because I am very, very much impressed with that negotiations record and how you have gone through it.

And there is no other way to interpret the language of that treaty, along with the negotiation record. I just do not see how you do it.

And yes, you can run all over the lot with respect to statements made. But I continue to read, even in the morning news, statements made by those who had no idea, did not go back, did not review—and act as if they are experts on the treaty or someone else is because they oppose SDI.

And I noted that word of caution when you said you wrote the letter in 1977, that you had not reviewed it at that particular time. A review of the negotiation record, since you have been at so many negotiations, can jog your memory. And this is what has occurred now, resulting in this statement that you give today.

Is that correct?

Ambassador NITZE. That is correct.

INTERPRETATION OF TREATY

I would just like to clarify one point. You rather suggested you were looking to me as kind of being more responsible for the broad interpretation than anybody else. Yesterday I was asked the question as to, how did I get involved in it, and I gave a response which I was not wholly clear on. It was from memory.

But then yesterday afternoon I looked into it in some greater detail and I found that really the origin of the view that the broader interpretation was correct was a little more complex. The way it arose was that originally in January 1985 we had unanimously, both in the State—well, it was unanimous amongst the Defense Department, the State Department, and the ACDA—come to the conclusion that the narrow interpretation was correct, and I agreed with that.

And then, later than that, some of our delegation in Geneva began getting questions from the Soviets. And so in order to answer those Soviets, they began to look into the negotiating record.

And then people in DDR&E in Defense began looking into it in greater detail, and they are the ones who commissioned studies to be made. And I believe it was their studies which then led to the hiring of Kunsberg—it was not Richard Perle; at least this is what I was told yesterday—and that as a result of Kunsberg's study, and not just that but also the work done by our Geneva negotiators looking at the record to find out in order to answer the Soviet questions, that they came to doubt that this narrow interpretation was correct, that there was any basis for it in the negotiating record.

And so it was after that, after the Pentagon lawyers had become persuaded of that, then we asked Mr. Sofaer, who was the new general counsel of the State Department, to look into it. And he also came to that conclusion.

It was at that point that I then went through as best I could parts of the negotiating record and did find that it seemed to me some of my recollections came back at that time as to what had happened. And in particular, I looked at some of the defenses for the narrow interpretation and found that in those defenses I thought there were clear gaps in the logic.

And so that it was after that that I came to the conclusion that I also agreed with the view that—and I am no lawyer, but I had come up with a view, but I myself was prepared to change what my view had been prior to that time. And so I supported their conclusion that the broad interpretation was the correct one, rather than the narrow.

And I just wanted to say that with respect to how this came about.

Senator HOLLINGS. That is extremely important, Mr. Ambassador, because of the deliberate way that you describe how men of good will have different views from time to time dispels this idea or notion that somehow the Administration is pell-mell for deployment of an SDI system, and thereby is trying to manufacture a new record and thereby change the treaty that the United States Senate has ratified. All such allegations are nonsense.

I was here in 1972. We never talked about BAMBI. We never talked about narrow and broad interpretations, none of those kinds of things. And we are looking now in a deliberate fashion, and even you, as one of the chief negotiators, acknowledge the fact that you had a different view and then, after closer examination and reflection, that you have come down on this particular point in this statement of yours.

So that has far more probative value. I am glad you are not a lawyer, because they do not believe any lawyers, I can tell you, around this town.

[Laughter.]

Senator HOLLINGS. Thank you very, very much, Mr. Ambassador. I appreciate the outstanding service you have given us all here.

Chairman STENNIS. All right.

Senator McClure.

NEGOTIATING RECORD

Senator MCCLURE Mr. Chairman, I will take only a moment. I was happy to yield to my colleague from South Carolina because I know of his interest in the subject and the involvement he has had in the discussions that have been undertaken so far.

Mr. Ambassador, I do not have any questions, but I do want to commend you on the thoroughness and the clarity of your presentation. I think that is one of the things we have been lacking in some of this discussion. And I do not charge anybody with bad faith in having done so.

But I agree with what Senator Hollings says. In essence, a treaty is what was negotiated between the parties, and the only place to find out what that negotiation was is to look at the negotiating record.

Unfortunately, when it comes to the explanation of that treaty after it is negotiated and signed, some people are less accurate with respect to their statements about what the words mean than is later borne out by an analysis of the negotiating record.

You have gone back to the negotiating record to determine what the treaty means, and I think that is exactly the appropriate way to make that determination. And to debate what was said some days or weeks or months afterwards in a different context, without looking at what was negotiated, I think is diversionary rather than helpful in determining the meaning of the treaty.

And I appreciate your testimony here today.

Thank you, Mr. Chairman.

Chairman STENNIS. Thank you, Senator.

Senator Cochran.

Senator COCHRAN. I have a question. Mr. Chairman, thank you.

TREATY INTERPRETATION IN BEST INTEREST OF U.S.

Mr. Ambassador, would you characterize the broad or narrow interpretation of the treaty as being in the best security interests of the United States? Which would be preferable?

Ambassador NITZE. I think the broad interpretation would be preferable from the standpoint of the security of the United States. And I want to say, I think the first question is which is correct.

Senator COCHRAN. No, I know that. That has already been asked and answered, as I understand it, before I got here.

But I do think it is important for us to understand the practical effect on the security of the citizens of the United States as to which interpretation we choose. And I think that you have answered it.

Thank you, Mr. Chairman.

Chairman STENNIS. Yes, sir. Thank you, Senator.

I have some other questions here, and I think several of them are important. I am going to ask just a few more of them.

COMMENDATION OF MR. NITZE

Chairman STENNIS. Gentlemen, it is hard for me to be carried away by a person because they happen to be learned or selective or capable. But we have a lot of testimony to consider every year, and some of it we find does not stand up too well.

And so I just want to say this. 25 years ago, I think it was around that time, I consulted with Mr. Nitze here on a matter for the Armed Services Committee. And I remember I went out to your home. You were pressed for time then, and I was invited by you to come out, and I went out there and got the information from you.

Your judgment was what I was looking for, and we used it, and it decided the question for the Armed Services Committee. And it was not anything I did, but what you did and what you pointed out, and what you said and what you analyzed.

And your name has come thundering on down these years to me as being a man who is not only qualified but is also careful to be precise and positive in answers.

Those of us who work on the Hill here, we are amateurs when it comes to science and physics and things of that kind. And we especially value those who will lead us out of the wilderness, so to speak. That is what you have done so successfully all these years, and all the members who have to work here owe you a debt of gratitude for that.

I have got notice here, gentlemen, that there is a vote on final passage of the jobs training bill. The vote is in progress now, so we will take a recess for anyone who wants to go vote.

Senator JOHNSTON. Mr. Chairman, could I use these couple of minutes?

Chairman STENNIS. Sure. I am not trying to close down now. I was just telling you what is pending. Yes, I would yield to you now if you wish.

Senator JOHNSTON. Thank you, Mr. Chairman.

TESTING OF EXOTIC TECHNOLOGIES

Mr. Nitze, we have talked about the broad or the narrow interpretation of the treaty, and generally that is a dispute about whether we can deploy or test systems based on exotic technologies—laser beams, excimer lasers, free electron lasers, et cetera.

That to me, at least as I read the treaty, that does not involve the question of whether physical principles well understood and known at the time the treaty was negotiated in 1972, whether those can be tested or deployed. Would you agree with that?

Ambassador NITZE. Yes, I do.

Senator JOHNSTON. Excuse me?

Ambassador NITZE. The technology involved on interceptor missiles and launchers for those interceptor missiles and in ABM radars, that technology and future developments of that technology is thoroughly caught by Article V.

Senator JOHNSTON. The point is that the argument about broad or narrow interpretation is a question of exotic technologies. It is not a question of whether you could use the technology well understood at that time.

Ambassador NITZE. That is correct.

VARIATION IN GUIDANCE SYSTEMS

Senator JOHNSTON. And that is what you meant, or at least if you take your letter, which you still agree with, your 1977 letter said: "It was our clear intention that Article V bar engineering development of the BAMBI type ABM system."

That would clearly then—if you were correct then, and you say you believe you were—that would clearly bar development or testing of the space-based KKV. And we are not talking about beam weapons, we are talking about space-based KKV; am I correct?

Ambassador NITZE. I am not sure of that, and the reason for that is there are other things besides the guidance system which might—well, let me begin again.

There is a question as to whether or not, if you had a brand new guidance system or guidance system quite different from the guidance system which existed in 1972, whether that guidance system would be based upon other physical principles.

Now, then there is the second question, as to whether, if part of a component is based upon another physical principle——

Senator JOHNSTON. What kind of physical principles? What is the difference in this guidance system?

Ambassador NITZE. All of the operative interceptors used radar for guidance at the time of 1972. The only ones that were contemplated that did not was the BAMBI system, which involved, as you say, infrared and, I forget, perhaps ultraviolet as well. I do not remember.

But in any case, the guidance system of BAMBI, which was never tested, which was conceived of at that time, was based upon other physical principles than those which were involved in the then deployed or contemplated interceptors.

Chairman STENNIS. Excuse me just one minute, please. I really am going to have to go over and vote on this bill, and so I am going to ask you to excuse me now. You gentlemen may proceed, though, if you want to ask more questions. The more you ask, the better, I think really.

I am going to come back if there is time at all. Remember, the witness does have to leave.

Thank you very much. You gentlemen, all of you will excuse me, I am sure.

KINETIC KILL VEHICLES

Senator JOHNSTON. My question is——

Ambassador NITZE. I had not quite finished my reply. The point I wanted to make is that when you said kinetic kill vehicles, which you were suggesting were all understood at the time and were therefore in a category of components banned, the testing of which could not take place in space, that I am raising a question with respect to the generality of the definition of "kinetic kill vehicle."

I think it is possible that kinetic kill vehicles with elements of them based on other physical principles could be called based upon other physical principles, and that this question is under review by the lawyers in the Pentagon and they have not come to a conclusion yet.

Therefore I do not want to express on behalf of the executive branch a definitive opinion, because I am not in a position to so do.

Senator JOHNSTON. Well, Mr. Nitze, if it were based on infrared, that was well understood in 1972. Radar was well understood in 1972.

Ambassador NITZE. I am not sure that—it is not just other than technologies understood in 1972. It is other than the technologies incorporated in the conventional components specified in Article II and mentioned again in Agreed Statement D.

It is a little bit different. What does the "other than" refer to, and the "other than" can be the technologies which were incorporated in the specified components.

Senator JOHNSTON. Well, that is not what Judge Sofaer said.

Ambassador NITZE. I am not sure that that is right. I think what I am talking about is a more precise statement.

Senator JOHNSTON. Well, let me see if I understand. You are saying that the treaty would not prohibit a space-based rocket system if it happened to deploy, to use, any kind of guidance that was not incorporated in the BAMBI system plans as of 1972?

Ambassador NITZE. I said that is something being considered by the lawyers in the Pentagon at the present time. I am not expressing an opinion one way or another on it.

Senator JOHNSTON. Well, when you said in your letter, "It was our clear intention that Article V bar engineering development of a BAMBI type ABM system," what did you mean by "BAMBI type ABM system"?

Ambassador NITZE. Well, I meant an interceptor launched from some platform in space to conduct an intercept with an element of a reentry vehicle in ballistic missile trajectory. That is what I meant.

Senator JOHNSTON. Is that not space-based KKV?

Ambassador NITZE. All I am trying to say is, there are refinements in this analysis which are under review in the Pentagon, and I do not want to express a definitive view on it.

Senator JOHNSTON. Well, I think you have made that clear, Mr. Nitze. But I am glad you still believe—you do still believe you were correct in your letter of 1977?

Ambassador NITZE. That is my view.

ACCESS TO NEGOTIATION RECORD

Senator JOHNSTON. Now, Mr. Nitze, finally, I am advised that, of course, the record—it is not a transcript, it is a record of the negotiations. I understand there were eight or nine people involved in that; that the others disagree with the so-called broad interpretation, but that they are not permitted access to go back and look at the negotiating record, even though they participated in that.

Do you know why that is and whether that can be changed?

Ambassador NITZE. Well, the arrangements under which the negotiating record was placed in Room 407 was so that it would be secure and would be made available only to the people that it was agreed it should be made available to.

And those included the Senators and a specified list of administrative assistants.

Senator JOHNSTON. Well, it seems to me fair, as well as—not only fair, but it would contribute to the national dialogue, to let those who—you know—what they say is, we do not agree with it. They have opinions somewhat like you did in 1977 and then Sofaer or others will come along and say: Yes, but you have not gone back and studied the treaty, even though they participated in the negotiations, and if you did do that research you would know.

Fine, let me go do the research. No, sorry, Catch 22; you cannot go look at the record.

Now, it seems to me that that is not contributing—I do not mean to blame you, but you happen to be with the administration and the only one I can speak to on the record at this time. It seems to me the administration in the interest of full disclosure ought to allow those people to go back and look at the record.

They are loyal Americans. Indeed, they were involved in the very treaty involved. And so I would urge you, Mr. Nitze—and I know it is under review, and I know you are a very, very valuable negotiating man for our team, and I do not want to get you in hot water with the administration.

But I hope, privately at least, you will stick to your view expressed in 1977, because there is no question in my view that you were correct in 1977, and there is no question that you were correct on March 30 of this year in your piece in the Washington Post.

And really the question now involved, you see, is whether we are going to deploy this prematurely, try to deploy this space-based KKV, which Dr. Harold Brown told us the other day, in effect, would never pass the Nitze test; it would be defeated by fast-burn boosters which the Soviets could have, at maybe 10 percent of the cost of the other.

Thank you very much. I think our real Chairman is coming back.

Ambassador NITZE. Thank you very much.

[Recess.]

Chairman STENNIS. I guess it is about time you are going to have to catch that plane. I came back to thank you again and to express appreciation to the other gentlemen, too. I think the testimony has been valuable, and I know it will be a great contribution.

If there is anything you want to add, you would be doing us a favor to do so.

Ambassador NITZE. Thank you very much, Mr. Chairman. I cannot count the number of times I have appeared before committees chaired by you, and I have always had a fair hearing and have enjoyed the hearing and I thought they have been a contribution, largely due to your wisdom and experience and chairmanship.

Chairman STENNIS. Well, thank you very much.

The main thing is that you have something worthwhile to say and to tell us, and we respect you highly. Good wishes to you and your staff.

SUBCOMMITTEE RECESS

The subcommittee stands adjourned.

[Whereupon, at 4:15 p.m., Thursday, April 2, 1987 the subcommittee was recessed, to reconvene at the call of the Chair.]

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